Report of the Fraser River Panel to the Pacific Salmon Commission on the 1999 Fraser River Sockeye and Pink Salmon Fishing Season

Prepared by the

Pacific Salmon Commission

March, 2001

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REPORT OF THE

FRASER RIVER PANEL

TO THE PACIFIC SALMON COMMISSION

ON THE 1999 FRASER RIVER SOCKEYE AND PINK

SALMON FISHING SEASON

1999 PANEL MEMBERS AND ALTERNATES

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March, 2001

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I. EXECUTIVE SUMMARY

1. Canada and the United States agreed on a renewed Annex IV of the Pacific Salmon Treaty on June 3, 1999. Chapter 4 of the Agreement provided catch sharing arrangements for Fraser River sockeye and pink salmon for the years 1999-2010. New provisions were added that formalize agreements that have guided the Panel in recent years. These include the definition of total allowable catch (TAC) for international sharing, the calculation of adjusted shares for harvest overages or underages in previous years, and the provision that all fisheries under the Panel's jurisdiction are "closed unless opened for fishing by in-season order of the Panel".

2. The Fraser River Panel managed commercial net fisheries and the Canadian "inside" troll fishery in the Panel Area in 1999 under the terms of the Agreement. The United States catch in Panel Areas (Washington) was not to exceed 22.4% of the Total Allowable Catch (TAC) of Fraser River sockeye salmon and 25.7% of the TAC of Fraser River pink salmon. Panel Area fisheries in Canada and Canadian fisheries outside the Panel Area were to be managed in a manner that anticipated and accommodated catches in United States fisheries.

3. Canada provided the Panel with run-size forecasts and spawning escapement targets for Fraser River sockeye and pink salmon on July 6. The forecast returns were 8,248,000 sockeye and 8,148,000 pink salmon, with spawning escapement targets of 2,687,000 adult sockeye and 6,000,000 pink salmon at the forecast abundances. The forecasts by timing group were 318,000 Early Stuart, 477,000 Early Summer, 5,328,000 Summer and 2,125,000 Late-run sockeye. Corresponding spawning escapement targets were 150,000, 260,000, 1,489,000 and 788,000 fish, respectively. Canada also forecast that 16% of Fraser sockeye would migrate through Johnstone Strait (i.e., diversion rate). The forecast of peak migration timing for Chilko sockeye in Area 20 was August 3. Canada also provided forecasts of diversion rate (41%) and Area 20 peak migration (August 28) for Fraser River pink salmon.

4. On July 15, Canada provided the Panel with gross escapement targets for adult sockeye. The targets were 146,000 Early Stuart, 374,000 Early Summer, 2,370,000 Summer and 798,000 Late-run sockeye, for a total of 3,688,000 fish. These numbers included management adjustments of 13,000 Early Stuart and 75,000 Early Summer sockeye, to compensate for historical differences between in-season and post-season estimates of gross escapement. The gross escapement target for pink salmon was 6,000,000 fish.

5. On July 16, the Panel adopted regulations for regulatory control of Panel Areas. The Panel also adopted a fishing schedule that was developed using the Fishery Simulation Model. Fisheries in 1999 were designed to focus on Chilko sockeye, the dominant Summer-run stock. Restrictions on fishing were expected early in the season to protect Early Summer sockeye and late in the season to protect Late-run sockeye. Forecasts of diversion rate through Johnstone Strait and peak migration dates that were provided by Fisheries and Oceans Canada (DFO) were accommodated in the fishing plan.

6. The Panel encountered three significant challenges to their management activities in 1999. First, abundances of Early Stuart, Summer and Late-run stocks were considerably below the respective forecasts, resulting in substantial reductions of planned fisheries. Second, abnormally high water flows in the Fraser River during the Early Stuart, Early Summer and early part of the Summer-run migrations caused difficult passage conditions in the Fraser Canyon and upstream of this point. These environmental conditions led to large en route and pre-spawning mortalities among Fraser sockeye stocks. Third, an unusual lack of delay of Late-run sockeye in the Strait of Georgia and their consequent early migration into the Fraser River made assessment of these stocks difficult. Subsequent large en route and pre-spawning mortalities of Late-run sockeye were likely related to the early upstream migration.

7. The estimated total return of Fraser River sockeye salmon in 1999 was 3,643,000 fish, less than half of Canada's pre-season forecast and the lowest on the cycle since 1955. The Fraser River

pink salmon return of 3,616,000 was also less than half of the forecast and the lowest odd-year return since 1965.

8. Restrictions on fishing were severe in both countries, primarily due to the low abundance of sockeye salmon. In the United States, only early fisheries in Juan de Fuca Strait (Areas 4B, 5 and 6C) were conducted. The Fraser River Panel was unable to approve commercial fishery openings in any other Panel area in either Washington or Canadian waters.

9. Catches of Fraser River sockeye salmon in all fisheries totalled 561,000 fish, which at 15% of the total run was the lowest harvest rate on record. Canadian catches amounted to 421,000 sockeye, United States fishers harvested 41,000 fish, and test fishery catches totalled 99,000 sockeye. Canadian catches included 49,000 in commercial, 347,000 in First Nations', 16,000 in recreational, and 4,000 fish in charter fisheries. Virtually all of the Canadian commercial catch occurred in non-Panel areas (Johnstone Strait). An additional 5,000 Weaver Creek sockeye were caught in an "excess salmon to spawning requirements" (ESSR) fishery in the Harrison River. Within the United States catch, 20,000 fish were harvested in Washington waters and 21,000 in Alaska. Commercial fishery catches in both countries summed to 90,000 fish, which represents a record low commercial exploitation rate of 2%.

10. Catches of Fraser River pink salmon totalled 163,000 fish: 131,000 in Canadian, 17,000 in United States and 15,000 fish in Panel-approved test fisheries. Commercial catches in both countries totalled only 10,000 fish. Included in the Canadian total were 7,000 fish in commercial, 65,000 in First Nations', 57,000 in recreational and 2,000 in ESSR fisheries. Most First Nations' and recreational catches occurred in marine areas. Within the United States total, the majority of fish (13,000 fish) were taken in recreational fisheries.

11. The Stock Monitoring program provided in-season estimates of abundance, migration timing and diversion rate of Fraser River sockeye and pink salmon throughout the fishing season. Because of the severe restrictions on fisheries, commercial catch data were not available for these purposes. Instead, in-season assessments in 1999 relied largely on Mission hydroacoustic estimates of daily escapement and on data from various test fishery operations.

12. Peak migration timing was near normal for Early Stuart (July 2 in Area 20), Summer-run (August 3 in Area 20) and Late-run sockeye (August 16 in Area 20). The peak migration date for Early Summer stocks in Area 20 was July 26. The estimated proportion of Fraser sockeye that migrated via Johnstone Strait (diversion rate) was 50%. For Fraser River pink salmon, the peak migration date (September 7 in Area 20) was ten days later than forecast, while the diversion rate through Johnstone Strait was very high at 80%.

13. The Racial Identification program provided estimates of stock composition for catches in commercial, Aboriginal and test fisheries. Such estimates were then used to estimate run size and gross escapement of individual stock groups. In 1999, scale characteristics, parasite data and length data were all employed to estimate the proportions of sockeye stock groups in mixed-stock fisheries. The primary difficulty encountered was in discriminating among Seymour/Scotch (Early Summer), Chilko/Quesnel (Summer) and Adams/Lower Shuswap (Late) stocks, due to a high degree of overlap in their scale characteristics. A post-season re-analysis using standards developed from spawning ground scales led to substantial revisions of racial composition estimates. For example, gross escapement estimates for Chilko sockeye increased 79%, while estimates for Seymour/Scotch and Adams/Lower Shuswap sockeye decreased 45% and 30%, respectively.

14. The return abundances of all four sockeye run-timing groups and of Fraser River pink salmon were less than forecast. The return of Early Stuart sockeye (171,000) was about half the pre-season forecast, Early Summer-run abundance (384,000 fish) was 81% of the forecast, Summer-run sockeye abundance (1,774,000 fish) was 33% of the forecast, and the Late-run return (1,311,000 fish) was 62% of the forecast. Chilko sockeye dominated the Summer-run return with an abundance of 1,125,000 and Adams/Lower Shuswap sockeye the Late-run return at 772,000 fish. The return of Fraser River pink salmon totalled 3,616,000 fish, or 44% of the forecast.

15. Preliminary estimates of spawning escapements to streams in the Fraser River watershed totalled 1,831,000 adult sockeye. This escapement was 6% larger than the brood year (1995) escapement of 1,731,000 adults and was the second largest escapement recorded on the cycle. An increase in the escapement of Chilko sockeye was responsible for the large total escapement. Compared to the brood year, escapements were 80% less for Early Stuart, 36% less for Early Summer, 38% more for Summer and 19% less for Late-run sockeye. Pink salmon spawning escapements totalled 3,453,000 fish. Elevated levels of pre-spawn mortality were observed in many sockeye spawning areas. The success of female sockeye spawning in the entire watershed averaged 90%.

16. Substantial en route mortalities of sockeye salmon were observed in the Fraser River, along tributary migration routes and in terminal areas in 1999. For early and mid summer stocks, the high mortality rate was due to unusually high river discharges during the upstream migration period. Such high flows create obstructions to fish passage in the Fraser Canyon and delay or impede migration at other sites in the Fraser watershed. For Late-run fish, the high mortality was due to an unexplained very early migration into the river and an outbreak of the myxosporean parasite, *Parvicapsula minibicornis*. Estimates of en route mortality by run-timing group are 139,000 Early Stuart, 200,000 Early Summer, 194,000 Summer and 716,000 Late-run sockeye, for a total of 1,249,000 fish.

17. Adjusted gross escapement targets (target + management adjustment) for sockeye salmon were nearly achieved or exceeded for each run-timing group based on lower river estimates (in-season Mission escapement plus First Nations' catch below Mission). Early Stuart and Early Summer gross escapements were both very close to the targets, while gross escapements of Summer and Late-run sockeye were 96,000 (8%) and 603,000 (68%) above the targets, respectively. The total gross escapement exceeded the adjusted target by 696,000 sockeye.

18. Upriver estimates of total sockeye gross escapement (catch plus spawning escapement) were 467,000 fish less than the total unadjusted target. By run-timing group, the escapements of Early Stuart, Early Summer and Late-run sockeye were 105,000 less (79%), 206,000 less (55%) and 445,000 less (50%) than the targets, respectively. Escapements of Summer-run stocks were 289,000 more (25%) than the target. The shortfalls in escapements were due to the large en route mortalities that occurred in 1999, which were not included in upstream estimates. The gross escapement of Fraser River pink salmon (3,524,000 fish) was considerably less than the target of 6,040,000 fish, due to the much lower-than-forecast total return.

19. The achievement of international allocation targets was severely impacted by the almost complete closures of commercial fisheries. For Fraser River sockeye salmon, the United States caught 20,000 of their share of 46,000 fish, or 9.8% of the TAC compared to their allocation of 22.4%. With respect to Fraser River pink salmon, the United States caught only 17,000 (11.5% of the TAC) of their allocation of 38,000 fish (25.7% of the TAC).

20. Domestic allocation goals could not be achieved in either country, again due to the extensive restrictions on fisheries.

II. FRASER RIVER PANEL

Under the Pacific Salmon Treaty, the Fraser River Panel is responsible for in-season management of fisheries that target on Fraser River sockeye and pink salmon within the Panel Area (Figure 1). Prior to the fishing season, the Panel recommends a fishery regime and a management plan for Panel Area fisheries to the Pacific Salmon Commission (PSC). The plan is based on: 1) abundance and timing forecasts and escapement targets for Fraser River sockeye and pink salmon stocks provided by Fisheries and Oceans Canada (DFO), 2) international allocation goals set by agreements between the Parties, 3) domestic allocation goals set by each country, 4) management concerns for other stocks and species identified by each country, and 5) historic patterns in migration and fisheries dynamics. The objectives that guide the Panel's decision-making are, in descending priority, to achieve: 1) targets for spawning escapement, 2) goals for

international allocation, and 3) goals for domestic allocation. The Parties' conservation concerns for other species and stocks are addressed throughout the process.

The pre-season management plan adopted by the Panel specifies a management scenario that is likely to achieve the escapement targets and catch goals, given the pre-season expectations. Using in-season commercial and test fishing data, estimates of daily escapement past Mission and estimates of stock composition, PSC staff provide in-season updates to the Panel on the abundance, timing and migration patterns by run-timing group. Based on this information and the goals for escapement and catch allocation, PSC staff make recommendations for fisheries. The Panel considers both the information and recommendations and decides on the appropriate course of action. In this way, the Panel modifies the fishing times stated in the plan to respond to deviations from pre-season expectations.

The activities of the Panel are facilitated by the Fraser River Panel Technical Committee, who provide the respective National sections of the Panel with technical advice.

On June 3, 1999, Canada and the United States agreed on a renewed Annex IV of the Pacific Salmon Treaty. Chapter 4 of the Agreement provided catch sharing arrangements for Fraser River sockeye and pink salmon for the years 1999-2010. Under the terms of the Agreement, the Panel exercised its regulatory mandate in the Panel Area in 1999 only for commercial net fisheries and the Canadian inside (Strait of Georgia) troll fishery. Development of management plans for other species and stocks intercepted in south coast regions is the responsibility of the Southern Panel and the Commission, with actual management in each region the responsibility of the appropriate country.

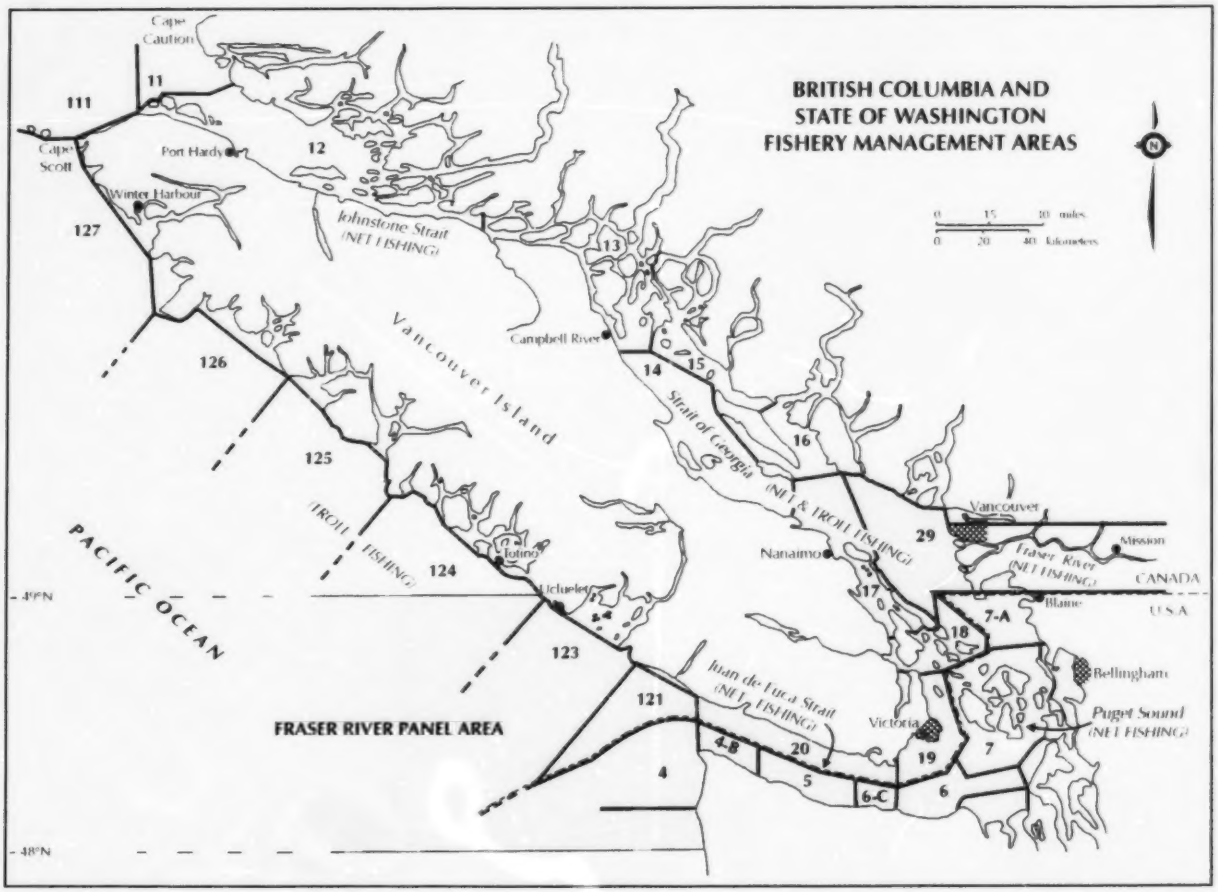

Figure 1. Fishery management areas and commercial gear used in the Fraser River Panel Area and Canadian south coast waters.

Input to the decision making process occurs primarily through the national sections of the Panel where most user groups are represented. The Panel membership and their affiliations during the 1999 season were:

CANADA	UNITED STATES
Members	
Mr. W. Saito, Chair Fisheries and Oceans Canada	Mr. D. Austin, Vice-Chair Washington Department of Fish and Wildlife
Mr. M. Chatwin Salmon processing industry	Ms. L. Loomis Treaty Indian tribes
Mr. M. Griswold Troll fisher	Mr. W. Robinson National Marine Fisheries Service
Mr. T. Lubzinski Gillnet fisher	Mr. B. Suggs Commercial salmon fishing industry
Ms. S. McKamey Canadian First Nations	
Mr. L. Wick Purse seine fisher	
Alternates	
Mr. B. Assu Purse seine fisher	Mr. D. Cantillon National Marine Fisheries Service
Dr. B. Hargreaves Fisheries and Oceans Canada	Mr. R. Charles Treaty Indian tribes
Ms. L. Johnson Canadian First Nations	Mr. T. Tynan Washington Department of Fish and Wildlife
Mr. W. Otway Sport fisher	Mr. R. Zuanich Commercial salmon fishing industry
Mr. L. Rombough Gillnet fisher	
Mr. S. Watterson Troll fisher	

III. INTRODUCTION

Canada and the United States reached agreement on a renewed Annex IV of the Pacific Salmon Treaty in June, 1999. Chapter 4 of the Annex concerns Fraser River sockeye and pink salmon and provides direction to the Panel for management of Panel Area fisheries. The new Annex provides catch sharing arrangements for Fraser River sockeye and pink salmon for the years 1999-2010. New provisions were added that formalized agreements that have guided the Panel in recent years. These include the definition of total allowable catch (TAC) for international sharing, the calculation of adjusted shares for harvest overages or underages in previous years, and the provision that all fisheries under the Panel's jurisdiction are "closed unless opened for fishing by in-season order of the Panel". This agreement brings stability to the conduct of fisheries.

The total return of Fraser River sockeye salmon in 1999 was 3,643,000 fish, compared to the pre-season forecast of 8,248,000 fish. This was the lowest return on the cycle since 1955 and the lowest of any year since 1980 (Figure 2). Low abundances of all run-timing groups (Early Stuart, Early Summer, Summer and Late) resulted in very low TAC's and severely restricted fisheries. Harvests of sockeye salmon totalled 561,000 fish in all areas, the lowest since records began in 1889. Similarly, low production of Fraser River pink salmon provided only limited directed fishing on these stocks.

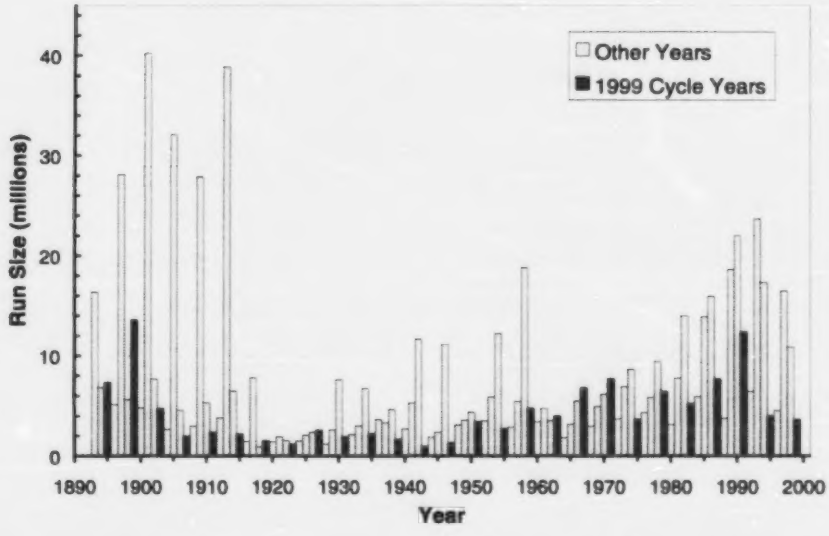

Figure 2. Total run sizes of Fraser River sockeye salmon between 1893-1999. Returns on the 1999 cycle are emphasized.

Environmental conditions appear to be largely responsible for the small return of Fraser River sockeye salmon stocks in 1999. Very low returns of age 4 sockeye were associated with the seaward migration of smolts from the Fraser River system during the 1997 El Nino event. The marine survival rate for Chilko sockeye smolts that migrated to sea in 1997 was the third lowest in the 46 years on record (Figure 3). Approximately 2.7% of Chilko smolts survived to return as age 4 adults in 1999, compared to the long-term average survival of 9.3%. In numbers, the age 4 Chilko return was approximately 1,046,000 fish, compared to the preseason forecast of 2,893,000. Similarly, the return of all other Fraser sockeye stocks combined was 1,916,000 age 4 fish, compared with the forecast of 4,963,000. The number of age 4 recruits per spawner from the parent (1995) brood was 1.7 fish/spawner, compared to a long-term average of 4.9 fish/spawner.

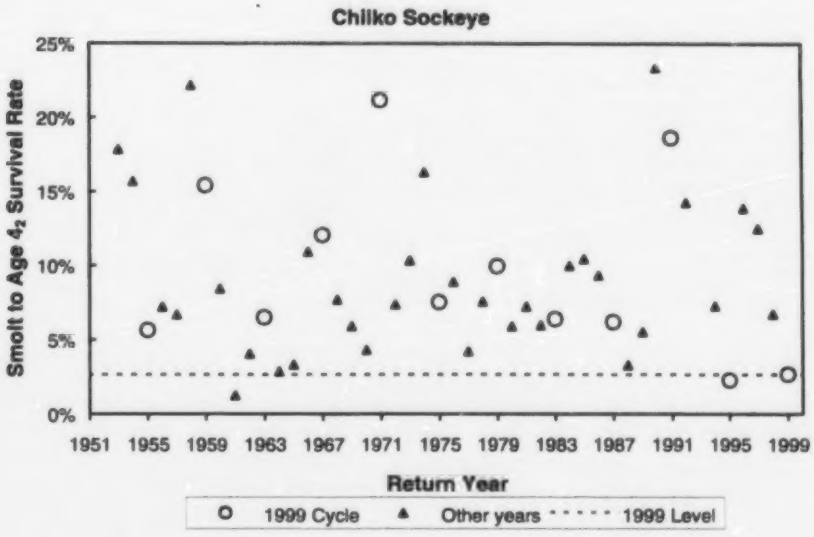

Figure 3. Survival rate of age 1 smolts to age 4_2 adult returns for Chilko sockeye for return years 1952-1999.

The low production from all Fraser sockeye stocks suggests that a common factor was responsible for the low rate of return. Based on the low marine survival rate observed for Chilko sockeye, the most likely cause for Fraser stocks generally was a low smolt-to-adult survival rate. Whether the low survival was caused by an increase in early mortality from predators (e.g., Pacific mackerel) that arrived on British Columbia's coast with the El Nino in 1997, or indirectly by poor growth and a consequent extended period of chronic mortality during early ocean residence, is unknown. Similar events occurred during the ocean life of Fraser River sockeye that returned as adults in 1995, the parent year of the 1999 age 4 return.

Unfortunately, the low return of age 4 sockeye was only part of the management difficulties faced in 1999. Following the El Nino of 1997-98, atmospheric conditions switched in mid 1998 to a La Nina state that was characterized by heavy precipitation throughout the Fraser River watershed in the winter of 1998-99. Above average snow pack levels were measured throughout the Fraser watershed and record high snow packs were observed at a number of coastal British Columbia and Washington mountain stations. Although spring flooding was a concern, cool spring and early summer air temperatures slowed the melting of the snow pack. This delay of the snowmelt meant that large amounts of snow remained in the mountains when sockeye began migrating into the Fraser River in late June. Heavy rains combined with melting snow produced high river discharges between the peak daily discharge on June 23 and the last high water event on August 1-2. The peak discharge at Hope, B.C., was 11,100 cubic meters per second (cms), which was the eighth highest since 1912. However, the average discharge from June 20 to August 15, during the passage of Early Stuart and Early Summer stocks and much of the Summer run, was 8,400 cms, the second highest in the 88-year period on record (1912-1999).

The high river discharge and velocity caused blockages and delay of the Early Stuart, Early Summer and Summer-run sockeye migrations in the lower Fraser Canyon (downstream of Hells Gate). The Early Stuart run was severely impacted by these events and approximately 80% of the escapement past Mission failed to reach the natal streams in the Stuart Lake watershed. Those that did arrive had experienced severe delays. For example, the first fish arrived at the enumeration weirs on spawning streams 11 days later than the previous latest date of first arrival. A high proportion of these fish were males, which tend to be larger, faster and have more energy reserves than females and, thus, are more successful at migrating upstream when river velocities are high.

In addition to en route losses and delays, the pre-spawning mortality rate of females on the spawning grounds was higher than average, and likely the result of stress associated with the difficult migratory conditions.

Many Early Stuart sockeye that were blocked in the Fraser Canyon for several days did not resume their upstream migration when water levels dropped to "passable" levels. In addition, fish that migrated past Hells Gate continued to experience high water levels in the river upstream of Hells Gate and many failed to reach their natal streams. Early Stuart sockeye were noted in tributary streams in the Nechako River area and numerous dead fish were observed in the Nechako River. Of the total gross escapement of Early Stuart sockeye into the river (167,000 fish), an estimated 83% (139,000 fish) died en route to the spawning grounds. These events paralleled the loss of Early Stuart sockeye in 1997 (52% loss), another year of extremely high river flows.

While fewer Early Summer sockeye were observed delaying, escapements of these stocks to natal streams also appear to have been negatively affected by high river flows. The impact of high river flows combined with low return abundance affected Early Summer stocks similarly to Early Stuart sockeye. Despite closure of in-river fisheries, escapements to spawning grounds were lower than brood year levels. About 54% (200,000 fish) of the gross escapement of Early Summer sockeye (367,000 fish) died en route, compared to 27% in 1997.

Summer-run escapements to the spawning grounds were near the post-season estimates of Mission escapement minus First Nations' and recreational catches above Mission. However, early-timed segments of these stocks were also delayed in arriving at their spawning grounds. The first Chilko sockeye arrived at Henry's Bridge on August 18, 33 days after this stock was first identified passing Mission. Also, the travel time for the peak of the Chilko migration at Mission to reach the spawning grounds was 23 to 26 days, compared to a normal period of approximately 19 days. Chilko sockeye experienced short-term delays in the Fraser Canyon due to high water events and, after passing Hells Gate, may have experienced slower-than-normal migration speeds due to the high river velocities that accompanied the above-average discharges. These river conditions were also experienced by other Summer-run stocks, with similar impacts on their travel time to the spawning grounds.

Late-run sockeye migrated upstream dramatically earlier than normal. In 1999, Late-run stocks migrated into the river between mid August and mid September, compared to a normal migration period of early September to early October. DFO personnel reported that Adams River sockeye experienced severe en route and pre-spawning mortality, beginning in mid-September in the South Thompson River and Shuswap Lake near the mouth of Adams River. Simultaneously, dead sockeye began appearing in Harrison River (Weaver Creek and Harrison River sockeye) and Chilliwack River (Cultus Lake sockeye). Samples taken for pathological examination revealed severe infections by the myxosporean parasite, *Parvicapsula minibicornis*, in kidneys and gills. Extensive mortality occurred among these stocks between mid September and their normal respective spawning periods (October and November). Preliminary estimates indicate that 716,000 Late-run sockeye perished before spawning (62% of gross escapement).

Fraser River pink salmon returns were estimated at 3,616,000 fish compared to the pre-season forecast of 8,148,000 fish. This was the lowest odd-year return since 1965 (Figure 4). Pink salmon that returned in 1999 were spawned in 1977 and migrated to sea in 1998, during the latter phase of the 1997-1998 El Nino. This brood of pink salmon may have encountered poor survival conditions such as were experienced by sockeye smolts that migrated to sea a year earlier in 1997. The marine survival rate of this brood was 1.4%, compared to the long-term average of 3.1%.

The combination of low sockeye and pink salmon returns, poor migration conditions in the river and large en route losses of sockeye salmon added up to one of the most disastrous years on record for fishermen from both countries. While spawning escapements were well below the targets for Early Stuart, Early Summer and Late-run stocks, the spawning escapement of Summer-run stocks was the largest on the cycle since at least 1955.

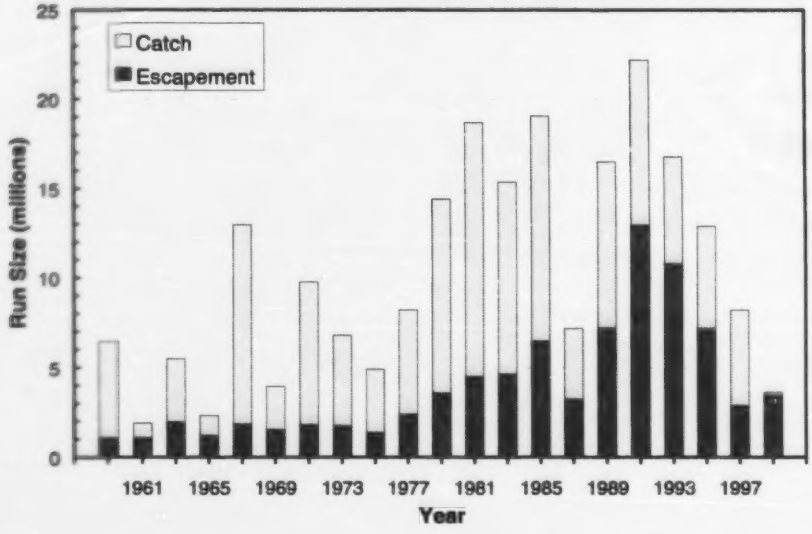

Figure 4. Total catches, escapements and run sizes of Fraser River pink salmon between 1959 and 1999.

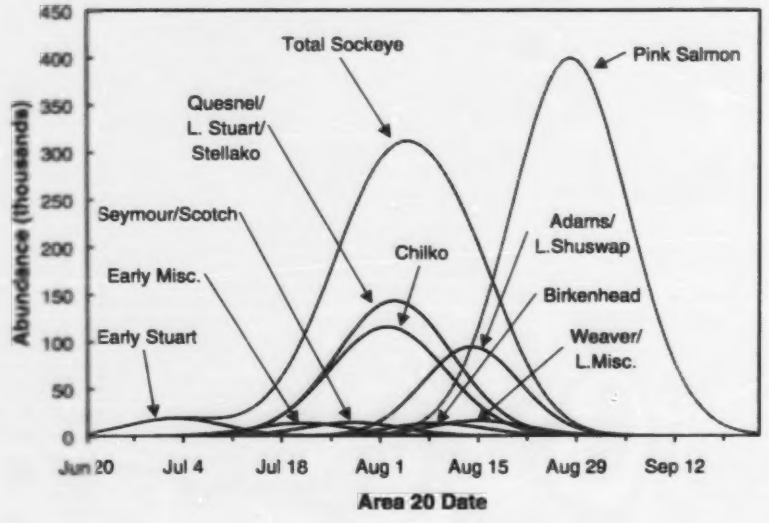

Figure 5. Expected daily abundance curves for migrating Fraser River sockeye and pink salmon in 1999 (Area 20 date), based on forecast abundances and timing patterns.

IV. MANAGEMENT ACTIONS

A. Forecasts of Returns, Escapement Targets, and Potential TAC

Canada provided the Panel with run-size forecasts and spawning escapement targets for Fraser River sockeye and pink salmon stocks on July 6, 1999 (Appendix A, Table 1). The forecast returns were 8,248,000 sockeye salmon and 8,148,000 pink salmon. DFO forecasts for returning sockeye included expectations by timing group as follows: 318,000 Early Stuart, 477,000 Early Summer, 5,328,000 Summer and 2,125,000 Late-run sockeye. Canada set spawning escapement targets of 2,687,000 sockeye and 6,000,000 pink salmon at the forecast run sizes. A method of calculating spawning escapement targets by sockeye stock group as a function of returning run size was also provided (Appendix A, Table 2). Actual escapement levels for pink salmon, however, were expected to depend on the timing and intensity of sockeye-directed fisheries.

PSC staff provided the Panel with daily abundance curves (Figure 5) for the arrival of Fraser River sockeye and pink salmon in Juan de Fuca Strait. This figure shows the expected timing and abundance of major stocks in 1999.

Forecasts of peak (50%) arrival timing of major stocks and of Johnstone Strait diversion rate (Figure 6) were provided by DFO to the Panel for planning purposes. Chilko River sockeye were forecast to have a normal peak arrival of August 3 in Area 20. Early Stuart, other Summer-run and Late-run stocks were also expected to have near-normal arrival timing. A Johnstone Strait diversion rate of 22% was forecast, based on sea surface temperatures. In August, DFO also provided forecasts of peak migration in Area 20 (August 28) and diversion rate (41%) for Fraser River pink salmon.

At the Panel meeting on July 15-16, 1999, Canada provided the Panel with its position on gross escapement targets of Fraser River sockeye and pink salmon for the purposes of calculating the United States share of the TAC. After review of the pre-season fishery modelling results, the United States accepted the targets, including management adjustments of 13,000 Early Stuart and 75,000 Early Summer sockeye to account for a historical trend in differences between in-season and post-season estimates of gross escapement. The adjusted gross escapement targets by timing group were 146,000 Early Stuart, 374,000 Early Summer, 2,370,000 Summer, and 798,000 Late-run sockeye (Table 1), as well as 6,000,000 pink salmon. In addition, for the purpose of calculating TAC's by run-timing group (Table 2), the Panel approved DFO's spawning escapement targets, PSC staff's projected test fishery catches, and an Aboriginal Fisheries Exemption of 400,000 fish as specified in Annex IV of the Treaty.

Table 1. Pre-season estimates of gross escapement targets by run.

Run	Spawning Escapement Target	Management Adjustment	Fraser Aboriginal Catch Target	Gross Escapement Target
Early Stuart	128,000	13,000	5,000	146,000
Early Summer	260,000	75,000	39,000	374,000
Summer	1,489,000	0	881,000	2,370,000
Late	788,000	0	10,000	798,000
Total	2,665,000	88,000	935,000	3,688,000

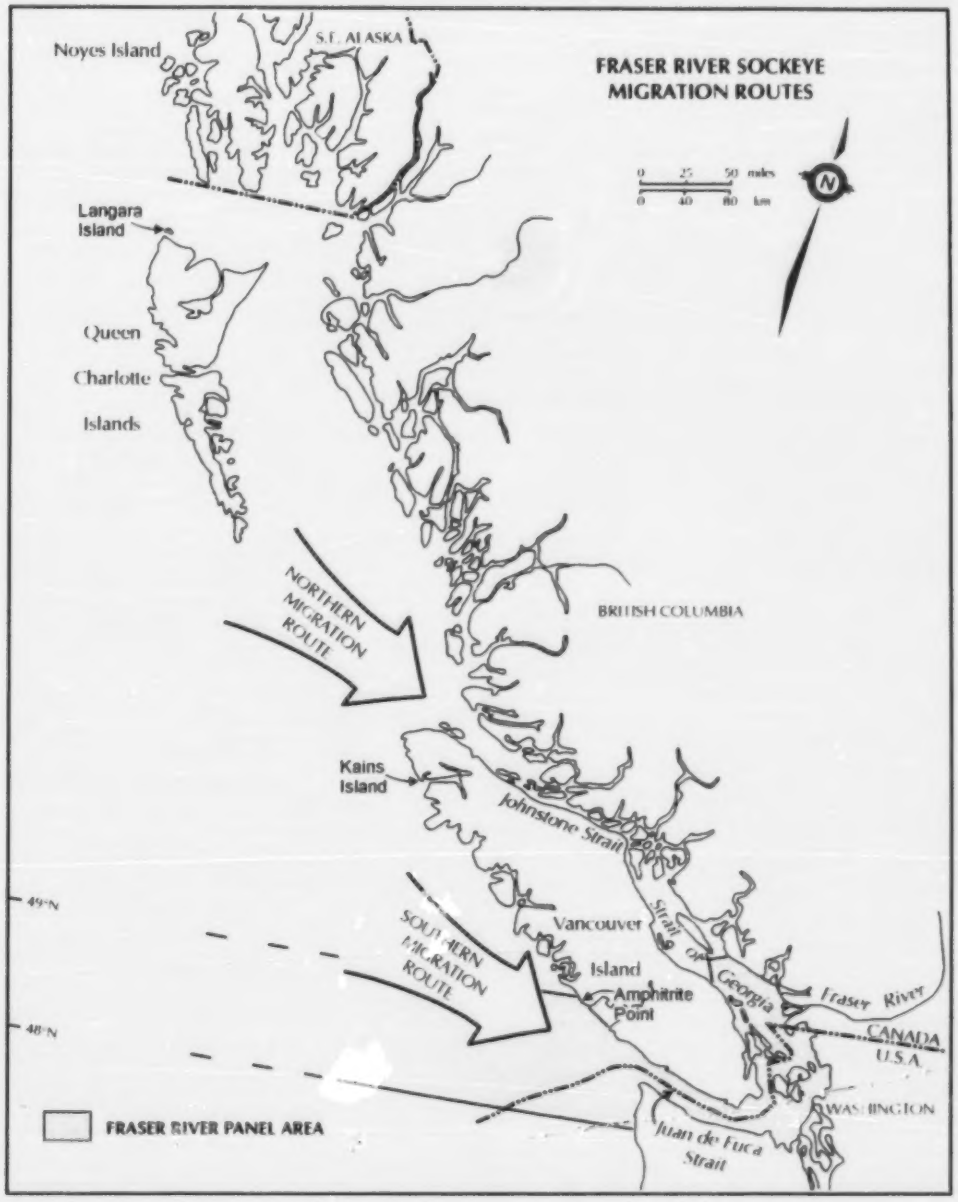

Figure 6. The northern (Johnstone Strait) and southern (Juan de Fuca Strait) routes for sockeye and pink salmon migrating to the Fraser River.

Table 2. Pre-season forecasts of total runs, spawning escapement targets and other deductions, and of total allowable catches by run.

Run	Forecast Run	Deductions: Spawning Escapement Target	Deductions: Management Adjustment	Deductions: Aboriginal Exemption	Deductions: Test Fishing	Total Allowable Catch
Sockeye Salmon						
Early Stuart	150,000 *	127,500	13,000	5,000	4,500	0
Early Summer	477,000	260,000	75,000	64,000	15,000	63,000
Summer	5,328,000	1,489,000	0	260,000	50,000	3,529,000
Late	2,125,000	788,000	0	71,000	30,000	1,236,000
Total	8,080,000	2,664,500	88,000	400,000	99,500	4,828,000
Pink Salmon						
Total	8,148,000	6,000,000	0	n/a	0	2,148,000

* Provisional in-season run-size estimate accepted by the Panel on July 6.

With these pre-season forecasts, escapement targets and test fishing catch estimates, the TAC's by run were: 0 Early Stuart, 63,000 Early Summer, 3,529,000 Summer and 1,236,000 Late-run sockeye, for an expected total TAC of 4,828,000 sockeye and 2,148,000 pink salmon (Table 2). Pre-season catch goals for Washington State fishers (22.4% of the sockeye TAC and 25.7% of the pink TAC) were 1,081,000 sockeye and 552,000 pink salmon. Goals for the domestic allocation of Fraser sockeye among Washington fishers were as follows: a) Treaty Indian and Non-Indian commercial net fishers were to receive equal shares; b) Treaty Indian fishers in Areas 4B, 5 and 6C were allocated a maximum of 20% of the Treaty Indian share; and c) for Non-Indian commercial gear, the traditional sharing targets of 54% for purse seines, 41% for gillnets and 5% for reefnets were identified as the management guidelines. Potential constraints on the Non-Indian guidelines were identified as: 1) reduced gillnet efficiency and participation due to the required use of a "seabird avoidance strip", 2) high diversion rate with weekly limited fishing opportunity, and 3) the usual priority ranking of conservation, international allocation and Treaty Indian/Non-Indian allocation before Non-Indian inter-gear sharing.

Canada did not identify a specific commercial TAC due to on-going negotiations with First Nations' to identify catch objectives in excess of the 400,000 Aboriginal exemption. However, DFO did provide sharing arrangements within the commercial sector as follows: 44% for Area B purse seines, 10% for Area D gillnets, 20% for Area E gillnets, 16% for Area G trollers, 8% for Area H trollers, and a fixed allocation of 68,000 for Area F trollers. The Area B purse seine allocation was expected to be taken in non-Panel Areas (Johnstone Strait) because Area 20 was to be closed to address conservation concerns for coho salmon.

B. Pre-season Regulations

On June 3, 1999, the Parties ratified a comprehensive agreement under the Pacific Salmon Commission, which included a 12-year sharing arrangement for Fraser River sockeye and pink salmon stocks. The Agreement provided new language for expired provisions of Annex IV of the Treaty. Under the Agreement, the United States catch in Panel Area (Washington) waters in 1999 was not to exceed 22.4% of the TAC of Fraser River sockeye and 25.7% of the TAC of pink salmon.

The Regulations and the Management Plan for the Panel Area in 1999 were developed using the run-size forecasts, gross escapement targets, and international and domestic allocation goals outlined above. Also considered were DFO's forecasts of the proportion of the run anticipated to migrate through Johnstone Strait (i.e., diversion rate), and the expected 50% migration dates for Early Stuart and Chilko runs to the lower Fraser River. The Management Plan was developed using the Fishery Simulation Model, with the intent to guide PSC staff in formulating fishery

recommendations to harvest the available TAC. Fishery plans in 1999 were focussed on the harvest of Summer-run Chilko sockeye. Restrictions on fishing were anticipated early in the season to protect Early Summer stocks and later in the season to protect Late-run sockeye stocks.

During the pre-season planning process, the Parties identified a number of conservation and management concerns. Species and stocks identified as being of concern to Canada included Skeena and Thompson coho salmon, Lower and Upper Georgia Strait and Johnstone Strait coho salmon, Nimpkish sockeye salmon, Thompson steelhead and Harrison chinook salmon. Species and stocks identified by the United States included Puget Sound summer-run chum and chinook salmon, and Lake Washington sockeye salmon.

On July 16, 1999, the Panel adopted regulations (Appendix B) for regulatory control of Panel Areas. The Commission accepted the regulations and submitted them to the Parties. In 1999, as dictated by the new Fraser Panel Annex, fisheries regulated by the Panel were to be "Closed Unless Opened" by in-season Orders of the Panel.

In the Management Plan, which was approved on July 20, fisheries in United States Panel Areas were anticipated to start during the week of July 25–31 in Areas 4B, 5 and 6C, and the week of August 1–7 in Areas 7 and 7A. Fisheries in Canadian Panel Areas were expected to open during the week of July 25–31 for Area H trollers and the week of August 8–14 for gillnets in Area 29.

C. In-season Regulations

Between July 6 and September 20, the Fraser River Panel conferred 23 times (by telephone or in-person) to discuss run status and enact in-season orders (Appendix C) to regulate fisheries directed at the harvest of Fraser River sockeye and pink salmon in Panel Areas.

For the third consecutive year, concerns developed over potential en route and pre-spawning mortalities of sockeye that migrated upstream of Mission. In 1999, concerns were related to abnormally high water flows in the Fraser River. DFO scientists made a series of weekly "forecasts" of potential pre-spawning mortality rates based on observed and forecast river discharges and migration timing of key sockeye stocks.

Due to the lack of certainty about Summer-run abundance and the effect of this uncertainty on the calculation of the Canadian catch share, Canada had difficulty in identifying gross escapement targets throughout the season. However, this uncertainty did not affect the Panel's ability to calculate the United States share, nor did it prevent Canada from regulating it's domestic fisheries that were outside of Panel control.

The following paragraphs summarize the events of the season on a weekly basis, with an emphasis on analyses and recommendations by PSC staff, and on Panel decisions.

On July 6, based on lower than expected escapements past Mission, the Panel adopted an interim run-size estimate of 150,000 Early Stuart sockeye, down from the pre-season forecast of 318,000 fish. At this run size there were no expectations for commercial fisheries. In addition, the Panel was briefed by DFO about abnormally high river discharges that were expected to result in difficult migration conditions for Early Stuart sockeye. These high discharge levels and unfavorable upstream passage conditions persisted over the following weeks and were monitored closely by DFO and the Panel. At the July 13 meeting, PSC staff reported on the potential for massive fish mortalities due to continuing high discharge levels. On July 20, DFO reported that the majority of Early Stuart sockeye would not reach their natal spawning grounds, based on current observations. While river discharges remained extremely high throughout the migration of Early Stuart sockeye, river levels were expected to drop below critical levels prior to the peak upstream migration of Early Summer stocks.

As expected, discharge in the Fraser River had moderated by July 23 and sockeye were observed actively migrating past Hells Gate. PSC staff reported to the Panel that the early component of the Early Summer run appeared to be near or above the forecast abundance.

However, concerns were developing about the strength of the Summer run because of apparent weakness of the 4_2 age class, as observed in samples taken from in-river and marine test fisheries. Based on the appearance of Summer-run sockeye in outside migratory areas, the Panel approved a fishery for United States Treaty Indian fishers in Areas 4B, 5 and 6C, as per the pre-season management plan.

During the week of July 26-August 1, discharge in the Fraser River remained high and passage conditions difficult. Blockages to fish migration, however, were not expected at the observed water levels. PSC staff projections of run size continued to indicate that the early timed component of the Early Summer run was at or above forecast levels. The Panel was also informed that the abundances of both Seymour/Scotch (a later-timed Early Summer stock group) and Summer-run stocks were tracking well below expectations based on the pre-season forecast. The Panel decided to continue the Treaty Indian fishery in Areas 4B, 5 and 6C because it was a low impact fishery and there would be a United States TAC even if the total Fraser return was only 50% of the forecast.

At the August 6 Panel meeting, DFO reviewed recent Fraser River discharge data and concluded that the migration of virtually every sockeye stock that migrated into the Fraser River in 1999 had been delayed by the high discharge levels. The Panel was informed that Early Stuart sockeye would probably experience severe en-route loss, and Early Summer and Summer runs would likely incur en-route losses as well. PSC staff expressed continued concern about weakness in the 4_2 age class and about how the abundances of the major stocks were tracking well below expectations. Based on available data and concerns about run strength, the Panel approved staff's run-size recommendations as follows: 400,000 Early Summer, 1,400,000 Summer (including 700,000 Chilko sockeye) and 1,100,000 Late-run sockeye (provisional estimate). These changes caused the TAC to drop to 266,000 fish, with a United States share of 59,500. In response to the reduced TAC, the Panel approved a United States proposal to close the Treaty Indian fishery in Areas 4B, 5 and 6C effective 6:00 p.m., August 6. The Panel discussed the impact of sockeye mortalities in Panel-approved PSC test fisheries. PSC staff were instructed to continue on-going test fisheries as per the pre-season plan, to maintain data flow and to monitor incoming sockeye and pink salmon runs.

In the following days, through to the August 13 Panel meeting, the daily numbers of Summer-run sockeye that migrated into the Fraser River were consistent with a run size of 1,400,000 fish. Similarly, indicators of Late-run abundance were consistent with the provisional run-size estimate of 1,100,000 fish, unless run timing was later than projected. All Panel Areas remained closed to commercial fishing due to the reduced run sizes. Discharge in the Fraser River declined during this time period, allowing sockeye to migrate through the Fraser Canyon. However, discharge levels remained at 50% above normal for the date and water temperature at Hells Gate had increased to 18°C. The combination of high discharge and temperature increased concerns about renewed sockeye delay in the Fraser Canyon.

On August 17, PSC staff reported that both discharge and water temperature in the Fraser River had moderated. Indices of daily sockeye passage at Hells Gate indicated that fish were actively migrating. At this meeting, PSC staff first identified the presence of Adams sockeye and Fraser pink salmon in the lower river, and expressed concern that these migrations had begun much earlier than expected. On August 18, the Panel accepted the following sockeye run-size estimates: 470,000 Early Summer, 1,300,000 Summer (including 650,000 Chilko River sockeye), and 1,100,000 Late-run sockeye (no longer provisional and including 750,000 Adams sockeye). At these abundances, the total Fraser River sockeye run in 1999 was projected at 3,020,000 fish, compared to the pre-season forecast of 8,248,000 fish. Due to continued low abundances of Fraser sockeye, all Panel Areas remained closed to fishing.

At the August 20 Panel meeting, PSC staff informed the Panel that the proportion of Summer-run stocks was declining in marine areas and the Summer-run return may not reach 1,300,000 fish, depending on the abundance in the tail of the run. Assessment of Late-run abundance was complicated by a lack of seaward data and by uncertainty in the purse seine test fishery CPUE expansion lines used to assess Late-run delay in the Strait of Georgia. Staff analyses showed that the Late-run return could deviate significantly from the current estimate of 1,100,000 fish if the expansion line was incorrect. With regard to pink salmon, concern was expressed about the

potential return abundance because low nutrient levels in offshore marine areas in 1998 coincided with the seaward migration of pink salmon juveniles. Staff informed the Panel that in-season run-size updates for Fraser River pink salmon would not be available until the run peaked in Johnstone and Juan de Fuca Straits in approximately two weeks.

On August 24, staff updated the Panel on the unusually early migration of Late-run sockeye into the Fraser River in 1999. Evidence of an early Late-run migration up the river took two forms. First, the observed travel time of fish between the Cottonwood test fishing site and Mission hydroacoustic site was about two days. This migration speed was consistent with normal Late-run behavior, compared to the normal Summer-run travel time of about one day. Staff considered this to be evidence of significant proportions of Late-run sockeye at Mission. Second, Adams sockeye were identified in samples taken from fish caught in the Yale fish wheel. This was concrete evidence that Late-run sockeye were actively migrating through the Fraser Canyon. This early migration was abnormal behavior for Late-run sockeye. There was continued uncertainty about estimates of Late-run abundance, depending on whether significant portions of Late-run stocks were delaying in the Strait of Georgia. However, staff recommended that the Panel continue to use 1,100,000 fish as the estimate of Late-run abundance. With regard to Summer-run sockeye, the total return was projected to be between 1,250,000 and 1,300,000 fish, unless there was a protracted migration. Of this total, approximately 1,000,000 fish were estimated to be Chilko and Quesnel sockeye. Resulting estimates of gross escapement were 450,000 to 475,000 Chilko sockeye, below the spawning escapement target of 500,000.

Between mid to late August, discharge in the Fraser River slowly declined to 4,100 cms on August 27. DFO reported that as a result of heavy rains in the upper watershed, river discharge increased to 4,750 cms on August 30. Concern was expressed about the potential effect of this increase on migrating sockeye, because this discharge level was much higher than the historical mean discharge in late August (3,000 cms). Water temperatures were generally favorable for sockeye migration throughout the watershed.

On August 31, staff recommended that the Panel increase the official run-size estimate for Late-run sockeye to 1,400,000 fish, including 1,000,000 Adams sockeye. No changes were recommended to the Summer-run estimate (1,300,000 fish). While staff did not feel there were sufficient data to deviate from the pre-season forecast of pink salmon abundance, preliminary data indicated the return would not exceed 6,000,000 fish and may only total 3,000,000 fish. The Panel discussed the possibility of conducting a two-day fishery in United States Panel Areas to harvest a portion of the United States TAC of 73,000 sockeye. Staff projected that such a fishery would harvest approximately 20,000 sockeye and 20,000 pink salmon. The Panel declined the fishery due to Canada's concerns about pink salmon run size. The United States, however, did not agree with a Canada's assertion that the anticipated by-catch of pink salmon could pose a conservation concern.

On September 3, staff projected that Late-run sockeye abundance would reach or exceed 1,400,000 fish due to the extended migration. Staff also reported that test fishing catches indicated a late surge of pink salmon had occurred in Johnstone Strait in recent days. The minimum run size was increased from 3,000,000 to 5,000,000, due to the later-than-expected timing of the Fraser pink salmon migration. Canada proposed a United States Panel Area fishery for the purpose of achieving the international sockeye allocation. The suggestion was later withdrawn, however, because the fishery would de facto be a directed pink salmon fishery and there was no remaining TAC on Fraser River pink salmon. Concern was expressed about the impacts that current environmental conditions would have on the earlier-than-normal migration of Late-run sockeye, since discharge in the Fraser River continued to be well above average for the time period.

On September 7, PSC staff apprised the Panel that the abundance of pink salmon in Johnstone Strait had increased over the past week. The diversion rate of pink salmon was estimated to be 90% over the last week and approximately 80% for the season. While staff continued to have difficulty assessing pink salmon run size, projections based on purse seine test fishing catches were for a minimum run size of 6,000,000 fish with point estimates in the 8,000,000 to 9,000,000 fish range. The Panel approved a staff recommendation to adopt the pre-season forecast of 8,100,000 Fraser River pink salmon as a working estimate of run size. At this time, the United States expressed frustration over the PSC staff's inability to provide an in-season estimate of pink

salmon run size. They stated that the decision to revert to the pre-season forecast could have been made earlier and factored into the decision-making process. The United States also stated they would not pursue a directed pink salmon fishery, even though a TAC existed, because of low abundances of pink salmon in United States Panel Areas and by-catch concerns for other species. In return, the United States asked Canada to acknowledge that the United States shortfall in sockeye and pink salmon catches in 1999 be considered catch underages, to be repaid in future years. Canada agreed that the United States would be entitled to future compensation, as per the Fraser Panel Annex, but that the actual number of fish in the entitlement would be determined through post-season bilateral discussion.

At the final in-season management meeting on September 20, the Panel was advised by staff that the end-of-season estimate of Summer-run sockeye return (1,373,000 fish) was close to earlier estimates, while the Late-run return (1,594,000 fish) was approximately 200,000 larger than expected. End-of-season estimates of Early Stuart and Early Summer abundance were 150,000 and 466,000 fish, respectively. The estimate of total abundance of Fraser River sockeye in 1999 was 3,583,000 fish. Staff provided an update on the abnormal Late-run migration pattern. As many as 80% of Late-run sockeye migrated into the Fraser River after only a short-term delay of approximately one week. These fish normally delay in the Strait of Georgia for three to four weeks before migrating into the Fraser River.

Pink salmon run size remained difficult to assess. Staff projections at the September 20 meeting were for a minimum run size of 6,000,000 pink salmon. The majority of pink salmon appeared to migrate into the Fraser River after a short-term delay, similar to the migration behavior of Late-run sockeye.

Fisheries in Panel Areas were severely curtailed in 1999 due to generally poor return abundances of both sockeye and pink salmon. The only Panel-approved fisheries occurred in United States Areas 4B, 5 and 6C, where Treaty Indian fisheries totalling 144 hours and 126 hours in duration occurred during the weeks of July 25-31 and August 1-7, respectively.

V. CATCH SUMMARY

A. Sockeye Salmon

The total return of 3,643,000 Fraser River sockeye salmon in 1999 (Table 3) was only 44% of the pre-season forecast of 8,248,000 fish. This total return was below the long-term average return on the cycle (5,398,000), and was the lowest on the cycle since 1955 (Figure 2). Five-year-old fish from the 1994 brood contributed approximately 19% of the total. The commercial (2.5%) and total (15.4%) harvest rates were the lowest on record.

Catches of Fraser River sockeye salmon in all fisheries totalled 561,000 fish (Table 3). Canadian catches amounted to 421,000 sockeye, while United States fishers caught 41,000. Catches in test fisheries authorized by the Fraser River Panel totalled 99,000 sockeye. Commercial fishery catches summed to 90,000 fish.

Preliminary estimates of spawning escapements totalled 1,833,000 sockeye, while an estimated 1,249,000 sockeye died between Mission and the spawning grounds due to environmental and disease factors (see Introduction).

Mean body weights of Fraser sockeye from Area 20 commercial purse seine catches are usually reported in this section of the Annual Report. In 1999, however, no commercial purse seine fisheries were conducted in Panel Areas, so average weights from purse seine test fisheries have been substituted. The average weight of age 4_2 Fraser sockeye caught in purse seine test fisheries in Area 20 was 2.54 kg (5.59 lb).

i. Canada

A total of 421,000 Fraser River sockeye salmon were harvested in commercial, First Nations' and non-commercial fisheries in Canada (Table 3). The commercial catch was 49,000 fish, including 1,000 in Panel Areas and 48,000 in non-Panel Areas.

Preliminary estimates of Canadian commercial catches of Fraser River sockeye salmon by gear type and area are presented in Table 4. Area B (southern) purse seines caught 2% of the Canadian commercial catch, while Area D (Johnstone Strait) gillnets caught 71%, Area G (outside) trollers caught 4% and Area H (inside) trollers caught 22%. Weekly catches in Canadian fishing areas are shown in Appendix D (Tables 1-4).

First Nations' fishers caught 347,000 sockeye, including 95,000 fish harvested in marine fisheries and 252,000 in the Fraser River (Table 3). The distribution of the Fraser River catch was: 41,000 fish in the Fraser River below Mission; 96,000 fish in the mainstem Fraser River between Mission and Sawmill Creek; and 115,000 fish above Sawmill Creek and in tributary fisheries (Appendix D: Table 5).

ii. United States

Fraser River sockeye catches in United States fisheries totalled 41,000 fish in 1999, 20,000 in Panel Area fisheries and 21,000 in Alaska District 104 (Table 3). Treaty Indian fishers in Areas 4B, 5 and 6C caught the entire United States sockeye catch in Panel Areas (Table 5). Weekly catches of Fraser River sockeye salmon in United States Panel Areas are shown in Appendix D (Table 6).

Table 3. Preliminary estimates of fishery catches, spawning escapement and total run of Fraser River sockeye salmon during the 1999 fishing season, by country and area.

	Number of Fish	% of Run
CANADA		
COMMERCIAL CATCH		
Fraser River Panel Area		
Areas 121-124 Troll	0	
Area 20 Net	0	
Areas 17-18 and 29 Troll	0	
Area 29 Net	1,000	
Total	1,000	0.0%
Non-Panel Areas		
Areas 1-10 Troll and Net	0	
Areas 11-16 Troll and Net	47,000	
Areas 124-127 Troll	1,000	
Total	48,000	1.3%
Commercial Total	49,000	1.3%
FIRST NATIONS CATCH		
Marine Areas		
Areas 12-16, 18, 20, and 123-126	71,000	
Area 29-1 to 7	24,000	
Total	95,000	2.6%
Fraser River		
Below Sawmill Creek	137,000	
Above Sawmill Creek	115,000	
Total	252,000	6.9%
First Nations Total	347,000	9.5%
NON-COMMERCIAL CATCH		
ESSR Fishery *	5,000	
Charter	4,000	
Recreational Fishery - Marine	2,000	
Recreational Fishery - Above Mission	14,000	
Non-Commercial Total	25,000	0.7%
CANADIAN TOTAL	421,000	11.6%
UNITED STATES		
COMMERCIAL CATCH		
Fraser River Panel Area		
Areas 4B, 5 and 6C Net	20,000	
Areas 6 and 7 Net	0	
Area 7A Net	0	
Total	20,000	0.5%
Non-Panel Areas		
Alaska Net	21,000	0.6%
UNITED STATES TOTAL	41,000	1.1%
TEST FISHING		
COMMISSION		
Areas 20 and 29 Test Fishing	53,000	
Area 7 Test Fishing	0	
Commission Total	53,000	1.5%
CANADA		
Areas 12 and 13 Test Fishing	46,000	1.3%
TEST FISHING TOTAL	99,000	2.7%
TOTAL CATCH	561,000	15.4%
SPAWNING ESCAPEMENT	1,833,000	50.3%
DIFFERENCE BETWEEN ESTIMATES **	1,249,000	34.3%
TOTAL RUN	3,643,000	100.0%

* Harvest of Weaver Creek sockeye in the terminal area that were Escapement Surplus to Spawning Requirement (ESSR).

** [Mission escapement plus First Nations' catch below Mission plus Upper Pitt River spawning escapement] - [total Fraser River First Nations' catch, ESSR catch, in-river recreational catch and spawning escapement]

Table 4. Preliminary estimates of Canadian commercial catches of Fraser River sockeye salmon by gear type, license designation and statistical area during the 1999 fishing season.

	Purse Seine		Gillnet			Troll			
Areas	Area A	Area B	Area C	Area D	Area E	Area F	Area G	Area H	Total
1-10	0		0			0			0
11-16		0		35,000	0		1,000	11,000	47,000
121-127		0		0			1,000		1,000
20		0			0		0		0
17, 18, 29		1,000			0			0	1,000
Total Catch	0	1,000	0	35,000	0	0	2,000	11,000	49,000
% of Catch	0.0%	2.0%	0.0%	71.4%	0.0%	0.0%	4.1%	22.4%	100.0%

* Catch data from DFO ticket sales slips.

Table 5. Preliminary estimates of United States commercial catches of Fraser River sockeye salmon by user group, gear type and statistical area during the 1999 fishing season.

Areas	Purse Seine	Gillnet	Reefnet	Total
		Treaty Indian		
4B, 5 and 6C	0	20,000	0	20,000
6 and 7	0	0	0	0
7A	0	0	0	0
6, 7 and 7A Total	0	0	0	0
% of Catch	0.0%	0.0%	0.0%	0.0%
Total Catch	0	20,000	0	20,000
% of Catch	0.0%	100.0%	0.0%	100.0%
		Non-Indian		
7	0	0	0	0
7A	0	0	0	0
Total Catch	0	0	0	0
% of Catch	0.0%	0.0%	0.0%	0.0%
		United States		
Panel Area Total	0	20,000	0	20,000
Alaska (District 104) Catch				21,000
Total Catch				41,000

* Washington catch data from Washington Department of Fish and Wildlife "soft system".

B. Pink Salmon

The total return of 3,616,000 Fraser River pink salmon (Table 6) was 44% of the pre-season forecast of 8,148,000 fish, and the smallest odd-year run since 1965.

Catches of Fraser River pink salmon in all fisheries totalled 163,000 fish: 131,000 in Canadian, 17,000 in United States and 15,000 fish in Panel-approved test fisheries. This was the lowest cycle-line catch since at least 1959. Commercial catches in both countries totalled 10,000 fish. Preliminary estimates of spawning escapements totalled 3,453,000 fish (Table 6).

Fraser River pink salmon in 1999 continued the trend in recent years toward a small body size. As with Fraser sockeye salmon, the lack of commercial purse seine fisheries made it necessary to obtain average weight data from purse seine test fisheries in Area 20. The average weight in 1999 (1.78 kg, 3.93 lb) compares to a mean of 1.68 kg (3.70 lb) in 1997 and a long-term mean of 2.29 kg (5.05 lb) for the years 1959–1997.

i. Canada

Included in Canada's catch of 131,000 Fraser pink salmon were 7,000 in commercial, 65,000 in First Nations', 57,000 in recreational and 2,000 in ESSR fisheries (Table 6). All of the commercial catch (Table 7) was taken in non-Panel Areas. Weekly catches in Canadian Panel Areas are shown in Appendix D (Tables 7-10).

In regards to First Nation's catches, the catch of 56,000 fish in marine areas may be the largest on record, while the catch of 9,000 fish in the Fraser River is the lowest since at least 1959. All First Nations' catches in the Fraser River were caught below Sawmill Creek (Appendix D; Table 11).

ii. United States

United States catches totalled only 17,000 fish (Table 6), including 3,000 in Treaty Indian fisheries in Areas 4B, 5 and 6C (Table 8) and 13,000 in recreational fisheries. Weekly catches in United States Panel Areas are shown in Appendix D (Table 12).

Table 6. Preliminary estimates of fishery catches, spawning escapement and total run of Fraser River pink salmon during the 1999 fishing season, by country and area.

	Number of Fish	% of Run
CANADA		
COMMERCIAL CATCH		
Fraser River Panel Area		
Areas 121-124 Troll	0	
Area 20 Net	0	
Areas 17-18 and 29 Troll	0	
Area 29 Net	0	
Total	0	0.0%
Non-Panel Areas		
Areas 1-10 Troll and Net	0	
Areas 11-16 Troll and Net	6,000	
Areas 124-127 Troll	1,000	
Total	7,000	0.2%
Commercial Total	7,000	0.2%
FIRST NATIONS CATCH		
Marine Areas		
Areas 12-16, 18, 20, and 123-126	13,000	
Area 29-1 to 7	43,000	
Total	56,000	1.5%
Fraser River		
Below Sawmill Creek	9,000	
Above Sawmill Creek	0	
Total	9,000	0.2%
First Nations Total	65,000	1.8%
NON-COMMERCIAL CATCH		
ESSR Fishery *	2,000	
Recreational Fishery - Marine	53,000	
Recreational Fishery - Above Mission	4,000	
Non-Commercial Total	59,000	1.6%
CANADIAN TOTAL	131,000	3.6%
UNITED STATES		
COMMERCIAL CATCH		
Fraser River Panel Area		
Areas 4B, 5 and 6C Net	3,000	
Areas 6 and 7 Net	0	
Area 7A Net	0	
Total	3,000	0.1%
Non-Panel Areas		
WA, OR and CA Troll	0	0.0%
Commercial Total	3,000	0.1%
NON-COMMERCIAL CATCH		
Recreational	13,000	
Ceremonial	1,000	
Non-Commercial Total	14,000	0.4%
UNITED STATES TOTAL	17,000	0.5%
TEST FISHING		
COMMISSION		
Areas 20 and 29 Test Fishing	11,000	
Area 7 Test Fishing	0	
Commission Total	11,000	0.3%
CANADA		
Areas 12 and 13 Test Fishing	4,000	0.1%
TEST FISHING TOTAL	15,000	0.4%
TOTAL CATCH	163,000	4.5%
SPAWNING ESCAPEMENT	3,453,000	95.5%
TOTAL RUN	3,616,000	100.0%

* Harvest of pink salmon in the terminal area that were Escapement Surplus to Spawning Requirement (ESSR).

Table 7. Preliminary estimates of Canadian commercial catches of Fraser River pink salmon by gear type, license designation and statistical area during the 1999 fishing season.

	Purse Seine		Gillnet			Troll			
Areas	Area A	Area B	Area C	Area D	Area E	Area F	Area G	Area H	Total
1-10	0		0			0			0
11-16		2,000		1,000	0		1,000	2,000	6,000
121-127		0		0			1,000		1,000
20		0			0		0		0
17, 18, 29		0			0			0	0
Total Catch	0	2,000	0	1,000	0	0	2,000	2,000	7,000
% of Catch	0.0%	28.6%	0.0%	14.3%	0.0%	0.0%	28.6%	28.6%	100.0%

* Catch data from DFO ticket sales slips.

Table 8. Preliminary estimates of United States commercial catches of Fraser River pink salmon by user group, gear type and statistical area during the 1999 fishing season.

Areas	Purse Seine	Gillnet	Reefnet	Total
Treaty Indian				
4B, 5 and 6C	0	3,000	0	3,000
6 and 7	0	0	0	0
7A	0	0	0	0
6, 7 and 7A Total	0	0	0	0
% of Catch	0.0%	0.0%	0.0%	0.0%
Total Catch	0	3,000	0	3,000
% of Catch	0.0%	100.0%	0.0%	100.0%
Non-Indian				
7	0	0	0	0
7A	0	0	0	0
Total Catch	0	0	0	0
% of Catch	0.0%	0.0%	0.0%	0.0%
United States				
Panel Area Total	0	3,000	0	3,000
Non-Panel Area Total				0
Total Catch				3,000

* Washington catch data from Washington Department of Fish and Wildlife "soft system".

VI. STOCK MONITORING

The purpose of the stock monitoring program is to assess run size, daily abundance, migration timing and diversion rate of Fraser River sockeye and pink salmon at different points along their migration route during the fishing season. This information is required for developing fishing plans to attain annual escapement and catch allocation objectives. Commercial catches usually provide much of the data used in the analyses. In addition, test fisheries (Table 9) conducted by the Commission or by DFO at the request of the Commission provide important data before and after the commercial fishing season and between fishing periods. Information about upstream migration in the river is obtained by test fishing in the lower river, echosounding at Mission, visual observations at Hells Gate and analysis of catches in Fraser River Aboriginal fisheries.

Table 9. Test fishing operations that were approved by the Fraser River Panel for the 1999 fishing season.

Area	Gear	Dates	Operated by
Canadian Panel Areas			
20	Purse Seine	July 24 - August 25	PSC
20	Gillnet	June 21 - August 21	PSC
29-13	Gillnet	July 7 - September 17	PSC
29-16	Gillnet	June 22 - September 21	PSC
29-1 to 6	Troll	August 11 - September 14	PSC
Canadian non-Panel Areas			
12	Gillnet	July 14 - August 13	DFO
12	Purse Seine	July 22 - August 29	DFO
13	Purse Seine	July 22 - August 29	DFO
United States Panel Areas			
7	Reefnet	July 19 - July 24	PSC

The upstream passage of sockeye and pink salmon was monitored at Mission between June 24-September 21. Before September 1, estimates of daily gross escapements of sockeye and pink salmon were derived by combining Mission hydroacoustic data with species composition data from gillnet test fishing at Whonnock (Area 29-16). After September 1, because of uncertainty about species composition estimates during periods of high pink salmon abundance, CPUE models based on data from gillnet test fishing at Whonnock were used to obtain estimates of fish passage.

The PSC and DFO jointly conducted the fifth year of an experimental split-beam hydroacoustic program in 1999 (see previous Fraser River Panel Annual Reports for details). This on-going work is directed towards the development of an improved hydroacoustic program at Mission. Most of the data were collected from fixed near-shore locations using two sideways oriented transducers. A downward oriented transducer was also deployed from the PSC transect boat for two days. In September, the split-beam hydroacoustics program detected high densities of pink salmon migrating in near-shore areas. Such high densities of fish reduce the reliability of hydroacoustic estimates of both sockeye and pink salmon passage. Thus, while the program continued to collect data for future analysis, daily hydroacoustic estimates were not reported.

Daily visual observations at Hells Gate between July 8 and October 8 supplied qualitative information about upstream fish passage.

A. Sockeye Salmon

Run-size estimation for Fraser River sockeye (by stock group) and pink salmon is based primarily on catch, effort, escapement, racial composition, run timing and diversion rate data. Traditionally, most of these data for Summer and Late runs come from commercial fisheries. However, limited commercial fishing in recent years has reduced the availability of this source of information. Test fishing catch and CPUE data are therefore used more extensively in assessing sockeye and pink salmon abundances than in previous years. These data are analyzed using catch-per-unit-effort, cumulative-normal and cumulative-passage-to-date models, which are described in previously published reports[1,2]. In addition, a Bayesian "Box-Car" or reconstruction-based model was employed for the first time in 1999. This model, which included features of the cumulative-normal and cumulative-passage-to-date models, implemented an objective method for combining the estimates from its component models based on the relative uncertainty of these models.

Each year, the first Fraser River sockeye stock to arrive in coastal waters is the Early Stuart run. Analyses in early July indicated the run size was less than 50% of the pre-season forecast (314,000). By July 9, estimates of run size ranged from 140,000-160,000 fish, still less than 50% of the forecast. In addition, concerns were raised about the effect of high water levels in the Fraser River on fish passage, and specifically about potential en route and pre-spawning mortality. The 50% point in the migration (Area 20 date) was July 2, one day earlier than the long-term average. At the end of the season, Early Stuart estimates included a run size of 150,000 and a gross escapement (escapement past Mission plus First Nations' catch below Mission) of 146,000 fish.

Later in July and in early August the focus was on Early Summer stocks. As in 1998, the assessment of Early Summer-run abundance in 1999 was complicated by the higher abundances of co-migrating Summer-run sockeye and by uncertainty in distinguishing Seymour/Scotch from Late-run Adams sockeye. In late July, the run-size estimate was 450,000 fish, close to the pre-season forecast of 477,000 fish. Final in-season estimates of Early Summer-run abundance and gross escapement were 466,000 and 445,000, respectively. The 50% migration point for Early Summer stocks in Area 20 was July 26.

The forecast 50% arrival timing for Summer-run stocks in Area 20 was equal to the long-term average of August 3. In early August, the Summer-run migration was tracking seven days later than the forecast, which raised concerns that the run size would be less than forecast. On August 6, run-size estimates were 1,000,000-1,500,000 sockeye. The Panel adopted an initial estimate of 1,400,000 fish. On August 18, the run size was reduced to 1,300,000. By the end of the season, estimates were of a total run of 1,402,000 with a gross escapement of 1,266,000 fish. The Area 20 50% migration point for Summer-run stocks was August 3.

The assessment of Late-run sockeye abundance was complicated by closures of commercial fisheries that historically have been vital for run-size estimation. A provisional run-size estimate of 1,100,000 fish was adopted on August 6, on the basis of relative weakness in the proportion of age 4_2 fish in the returns of earlier-timed stocks. This pessimism was supported by small catches of Late-run sockeye in purse seine test fisheries in Areas 12, 13 and 20. Assessments throughout August continued to be consistent with this abundance. The estimate of Late-run abundance was increased to 1,400,000 fish on August 31, based on assessments of the very early upstream migration and on a late tail of abundance observed in the Areas 12, 13 and 20 purse seine test fisheries. The subsequent migration past Mission of Late-run stocks was larger than expected. By the end of the season, the total run size was estimated at 1,623,000 with a gross escapement of 1,495,000 fish. The 50% migration point for Late-run sockeye in Area 20 was August 16.

Sea surface temperatures throughout the north Pacific dropped dramatically from very high levels in 1997-1998 to very cold temperatures in May and June of 1999. Such low temperatures had not been observed at this time of year since the mid 1970's. Based on these low ocean

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[1] Pacific Salmon Commission. 1995. Pacific Salmon Commission run-size estimation procedures: An analysis of the 1994 shortfall in escapement of Late-run Fraser River sockeye salmon. Pacific Salmon Com. Tech. Rep. No. 6: 179p.

[2] Pacific Salmon Commission. 1998. Report of the Fraser River Panel to the Pacific Salmon Commission on the 1995 Fraser River sockeye and pink salmon fishing season. Vancouver, B.C.

temperatures, the diversion of sockeye through Johnstone Strait was forecast to be 16%, which if realized would have been the lowest since 1988. However, by the end of the first week of August the estimated diversion rate was 60%, where it remained throughout August. The weighted average Johnstone Strait diversion rate for the season was 50%.

Figure 7 shows patterns of daily migration in the river as measured by Cottonwood test fishing CPUE data, and by estimates of escapement from Mission hydroacoustic and Whonnock test fishing programs. Daily passage estimates were obtained using hydroacoustic methods until August 31 and Whonnock test fishing CPUE models thereafter. The Cottonwood data are lagged one to two days, which is the estimated travel time for sockeye between the Cottonwood and Mission sites. The start dates for the test fishery at Whonnock and the hydroacoustics program at Mission were postponed for one week until the first week in July, due to record high water levels in late June. The Cottonwood test fishery did not commence until July 25 because of the high water levels.

Observations at Hells Gate indicated the passage of sockeye was abnormally delayed during the middle period of July. These delays were presumably due to the very high water levels and, as mentioned previously, mortalities were anticipated at these water levels. The passage of sockeye proceeded normally after early August, with no evident delay in migration.

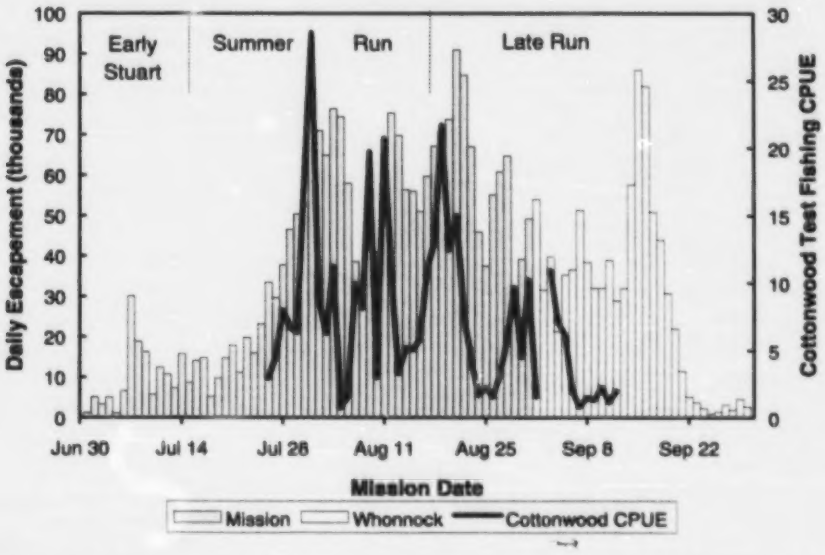

Figure 7. Daily escapements of sockeye salmon estimated by echosounding at Mission and by use of Whonnock test fishing CPUE models, compared with test fishing CPUE's at Cottonwood one or two days earlier.

B. Pink Salmon

As with sockeye, assessments of the migration of Fraser River pink salmon in marine areas in 1999 were based entirely on data from purse seine test fisheries because of the absence of commercial fishing. Consequently, confidence in run-size estimates for Fraser River pink salmon was of concern. Escapement to the Strait of Georgia was estimated by expansion of CPUE data from the purse seine test fisheries. Proportions of Fraser River pink salmon in these catches were initially estimated using pre-season forecasts of racial composition. Approximately one week after each fishery, these proportions were replaced by Genetic Stock Identification (GSI) estimates.

The peak (50%) arrival date in Area 20 was forecast to be August 28. By the end of August, the run appeared to be late and the total return was estimated at 6,000,000 fish. During the first week of September, purse seine test fishery catches increased dramatically in Areas 12 and 13. On September 7, estimates of run size ranged from 6,000,000 to 9,000.000 fish. At the end of the season, the estimate of minimum run size remained at 6,000,000.

In 1999, approximately 80% of Fraser River pink salmon migrated through Johnstone Strait. This calculation was based on purse seine test fishing estimates of abundance and compares to the long-term average of 37% (1959-97). The 50% migration date (Area 20 timing) of September 7 was nine days later than forecast.

The pattern of daily pink salmon escapements in the Fraser River, measured by Cottonwood test fishing CPUE (lagged two days) and Duncan Bar CPUE data is shown in Figure 8. The extreme near-shore migration of pink salmon that was identified in 1999 precluded reliable estimates being obtained from the regular transecting program at Mission.

Pink salmon migrated upstream past Hells Gate without accumulation or delay. The abundance of pink salmon above Hells Gate could not be confirmed, however, because spawning ground enumerations at Bridge River, Seton Creek and Thompson River have not been conducted since 1991.

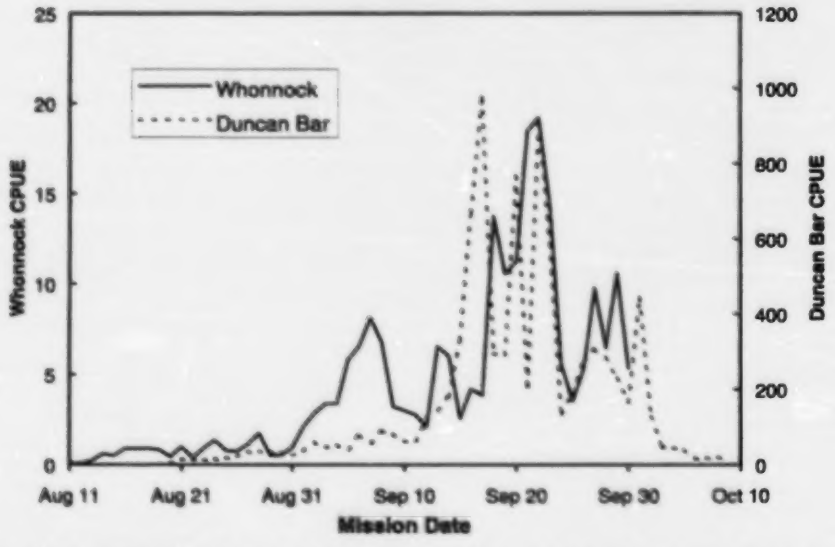

Figure 8. Daily CPUE data for pink salmon in the test fishery at Whonnock and in DFO's beach seine fishery at Duncan Bar on the same day.

VII. RACIAL IDENTIFICATION

PSC staff conduct programs designed to identify the stock proportions of Fraser River sockeye and pink salmon in commercial, test and First Nations' catches. These data provide information on the abundance and timing of sockeye stocks as they migrate to the Fraser River and their natal streams. Racial data are also used to account for international and domestic catches of Fraser River sockeye and pink salmon in coastal waters, and to apportion the daily estimates of sockeye escapement past Mission into discrete stock groups. Except where noted below, racial analysis methods in 1999 were similar to past years.[3,4]

A. Sockeye Salmon

Analyses of scale samples from catches in commercial and test fisheries were conducted daily, beginning in late June and continuing through mid September. Commission staff sampled test fishing catches and commercial sockeye landings at sites in Vancouver, Steveston, Port Renfrew, and Port Hardy, B.C. Alaska Department of Fish and Game (ADF&G) collected samples from the District 104 net fishery at landing sites in Petersburg and Ketchikan, Alaska. DFO provided samples from Johnstone Strait purse seine test fisheries. In addition, DFO and First Nations' personnel co-ordinated weekly scale sampling from Fraser River First Nations' fisheries at four locations: Chilliwack, Yale, Lytton and Bridge River.

i. Analyses

In 1999, the numerically dominant stocks were Chilko, Quesnel, Late Stuart, Stellako, Adams (i.e., Adams/Lower Shuswap) and Weaver. These stocks, in combination with other numerically smaller stocks, were pooled to form nine unique stock groups on the basis of scale patterns and migration timing: Early Stuart, Fennell/Bowron/Raft, Pitt/Nadina/Gates, Seymour/Scotch, Quesnel/Chilko, Late Stuart/Stellako, Birkenhead, Adams and Weaver/Portage. For most analyses in 1999, the nine stock groups were incorporated into two categories of in-season models: 1) models with Early Summer and Summer-run stock complexes, and 2) models with Summer-run and Late-run stock complexes.

Stock specific baseline standards used for in-season racial analyses come from two sources. First, age 4_2 standards are constructed using scales from the previous year's spawning grounds returns of age 3_2 fish (jacks), while age 5_2 standards are created using scales from the previous year's age 4_2 returns. These siblings of current year age 4_2 and 5_2 fish will have reared together in the lake and thus have similar freshwater scale patterns. Second, when sibling data from the previous year are unavailable; baseline standards are developed using data for the same age class from other prior years. In recent past years, low returns of age 3_2 Fraser sockeye have greatly reduced jack samples sizes. In 1998, only three stocks had sufficient jack samples to develop age 4_2 standards for 1999: Gates (n=171), Chilko (n=105) and Birkenhead (n=64). Although small jack samples were also available for Late Stuart (n=45), Stellako (n=22), Lower Adams (n=33), Weaver (n=39) and Cultus stocks (n=42), the majority of scales for age 4_2 standards for these stocks and all others stocks came from prior years' age 4_2 returns. Reliance on age 4_2 standards created from past years' age 4_2 scales reduces the accuracy of in-season baseline standards compared to years when large numbers of sibling scales from the previous year's age 3_2 population are available.

Discriminant Function Analysis (DFA) classification matrices from standards developed pre-season predicted that some significant problems would occur in distinguishing stock groups in 1999. The first difficulty in the application of DFA models was a relatively high rate of misclassification (up to 24%) between the two abundant Summer-run stock groups (Quesnel/Chilko and Late

[3] Gable, J.H. and S.F. Cox-Rogers. 1993. Stock identification of Fraser River sockeye salmon: methodology and management application. Pacific Salmon Comm. Tech. Rep. No. 5: 36 p.

[4] Pacific Salmon Commission. 1999. Report of the Fraser River Panel to the Pacific Salmon Commission on the 1997 Fraser River sockeye and pink salmon fishing season. Vancouver, B.C.

Stuart/Stellako) and the three less abundant Early Summer groups (Fennell/Bowron/Raft, Pitt/Nadina/Gates and Seymour/Scotch). To correct for misclassifications between stock groups, a bias correction procedure (Cook and Lord, 1978)[5] was applied. Even with bias correction, however, when stocks with similar scale characters differ greatly in abundance, DFA models (and other analytical techniques such as Maximum Likelihood Analysis) tend to overestimate stocks present in low proportions and underestimate stocks present in high proportions. We therefore used similar strategies as in past years [6] to minimize the bias.

The second and most significant difficulty in the application of DFA models in 1999 was a very high degree of overlap in the scale patterns of Seymour/Scotch, Chilko/Quesnel and Adams/Lower Shuswap stock groups. In-season models based on samples from Chilko and Adams jacks in 1998 had misclassification rates of 36% for Chilko and 49% for Adams. Jack samples were unavailable for the Seymour/Scotch group. Both Seymour/Scotch and Adams sockeye rear in Shuswap Lake and, therefore, they cannot be distinguished based on freshwater scale patterns. However, the early segment of the Chilko/Quesnel stock group overlaps with the Seymour/Scotch group, while the latter segment overlaps with the Adams group. Consequently, our normal stock identification methods were unable to discriminate among these three stock groups. We attempted to overcome this problem using a multi-step method based on body size and parasite data.

First, we used the DFA model to estimate proportions of the combined three-stock complex of Chilko/Quesnel, Seymour/Scotch and Adams. Second, we knew from historical data that Chilko sockeye are consistently smaller than Quesnel sockeye and from either of the Shuswap stock groups. Third, using data from 1998, we determined a body length cut-off for males and females, below which virtually all fish would be Chilko fish. We then estimated the sample proportions for Chilko by tallying the number of males and females below the length cut-off and dividing these numbers by the proportion of Chilko males and females expected to be shorter than the cut-off (based on 1998 samples). Fourth, the proportion of Quesnel fish was estimated from the prevalence of the brain parasite, *Myxobolus articus.*[4] Seymour/Scotch/Adams proportions were then estimated by subtracting the Chilko and Quesnel estimates from the three-stock group total. Seymour/Scotch and Adams proportions were derived from a method based on variation in their migration behavior. [2]

The body cavity parasite, *Philonema oncorhynchi*, is virtually absent from most Fraser River sockeye stocks but has a high prevalence in stocks from northern British Columbia and Southeast Alaska. In 1999, *Philonema* prevalence and age composition data were used to provide in-season estimates of Fraser River sockeye contribution rates in District 104, Alaska, purse seine fisheries. From past years' data, it has been shown that *Philonema*-based estimates of Fraser proportions are similar to estimates based on post-season DFA analysis of scale patterns.

Post-season racial analyses were performed using revised baseline standards derived from spawning ground scale samples in 1999. The major component stocks in each stock group were the same in the post-season and in-season DFA models, with the exception that scale patterns caused the Quesnel stock to be included with the Late Stuart/Stellako stock group in the post-season models rather than with the Chilko group.

ii. Estimates of Escapement and Production by Stock Group

To isolate the effects of in-season to post-season changes in racial composition estimates, estimates of gross escapement (hydroacoustic and CPUE-based) by stock group based on in-season racial data were compared to estimates in which post-season racial standards were applied (Table 10). The post-season analysis resulted in relatively large changes from the in-season estimates for some stock groups. The largest proportional shifts occurred among the stock groups that had confounded freshwater scale characteristics, namely Seymour/Scotch (45% decrease), Chilko (79% increase) and Adams (30% decrease). Because the scale models could not separate these three stock groups, the shifts were due to a change in the method used to apportion the three stocks. In the post-season analysis, we estimated Chilko gross escapement using a run

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[5] Cook, R.C. and G.E. Lord. 1978. Identification of stocks of Bristol Bay sockeye salmon (*Oncorhynchus nerka*) by evaluating scale patterns with a polynomial discriminant method. Fish. Bull., U.S. 76: 415-423.

[6] Pacific Salmon Commission. 2000. Report of the Fraser River Panel to the Pacific Salmon Commission on the 1998 Fraser River Sockeye fishing season. Vancouver. B.C.

reconstruction technique based on upstream estimates of abundance (spawning escapement plus in-river First Nations' catch plus assumed en-route loss) and timing data derived from Henry's Bridge counts. Seymour/Scotch and Adams were then estimated by subtraction of Chilko estimates from the combined estimate for the Chilko/Quesnel, Seymour/Scotch and Adams groups. Differences between the in-season and post-season methods used to separate Chilko from Seymour and Adams stocks resulted in increased estimates of Chilko contributions and decreased estimates of Seymour/Scotch and Adams contributions.

Smaller Birkenhead contributions and larger estimates of Early Stuart, Fennell/Bowron/Raft, and Late Stuart/Stellako contributions were mainly due to shifts in scale characteristics between pre-season and post-season standards. Estimates of Pitt/Nadina/Gates contributions increased in the post-season because Pitt sockeye were included post-season but not in-season. The high river discharges that were observed during the in-season period reduced the efficiency of the Cottonwood test fishery, which prevented accurate assessments of Pitt abundance. Higher rates of *myxobolus* prevalence in the post-season parasite data for Quesnel sockeye reduced the expansion factor that was applied to mixed-stock samples, which decreased the Quesnel estimate.

Table 10. Comparison of in-season and post-season estimates of gross escapement of Fraser River sockeye salmon stocks in 1999.

Run	Gross Escapement *		Difference	
	In-season	Post-season	Fish	%
Early Stuart	146,000	167,000	21,000	14%
Early Summer				
Fennell/Bowron/Raft	48,000	55,000	7,000	15%
Nadina/Gates/Pitt	164,000	185,000	21,000	13%
Seymour/Scotch	233,000	127,000	(106,000)	-45%
Total	445,000	367,000	(78,000)	-18%
Summer				
Chilko	584,000	1,045,000	461,000	79%
Quesnel	416,000	310,000	(106,000)	-25%
Late Stuart/Stellako	266,000	298,000	32,000	12%
Total	1,266,000	1,653,000	387,000	31%
Late				
Birkenhead	224,000	185,000	(39,000)	-17%
Adams/L. Shuswap	978,000	685,000	(293,000)	-30%
Weaver/Portage	293,000	293,000	0	0%
Total	1,495,000	1,163,000	(332,000)	-22%
Total	3,352,000	3,350,000	(2,000)	0%

* Escapement past Mission plus Aboriginal catches below Mission.

The total return of Early Stuart sockeye (171,000, Table 11) was 54% of the pre-season forecast (318,000). Recorded catches for this stock were very small, consisting of 4,000 in test and miscellaneous non-commercial fisheries and 3,000 in Fraser River First Nations' fisheries. The exploitation rate for all catch areas was 4%. An estimated 139,000 Early Stuart sockeye perished during their upstream migration.

The estimated return of Early Summer stocks was 384,000 (Table 11), about 19% less than the pre-season forecast of 477,000. Catch estimates for Early Summer sockeye include commercial, test fishery and miscellaneous non-commercial catches of 17,000 fish. In addition, 64,000 fish were caught in Fraser River First Nations' and recreational fisheries. The exploitation rate on Early Summer stocks was 21%. Approximately 200,000 Early Summer sockeye died during the upstream migration.

The estimated return of Summer-run stocks was 1,774,000 fish (Table 11), which was about 33% of the pre-season forecast (5,328,000 fish). Chilko sockeye dominated the Summer run with a total return of 1,125,000. The other Summer-run stock groups, Quesnel and Late Stuart/Stellako had total returns of 331,000 and 318,000, respectively. Commercial, test and marine First Nation's catches totalled 121,000 fish, while Fraser River First Nations' and recreational catches totalled 177,000 fish. The exploitation rate for Summer-run stocks in all fisheries was 17%. Lower-river estimates of upstream Summer-run migration exceeded upriver estimates (catch + spawning escapement) by 194,000 fish.

The pre-season forecast for Late-run stocks was a return of 2,125,000 fish. The estimated return was 1,311,000, approximately 814,000 fish (38%) less than forecast. Adams sockeye dominated the Late-run production with an estimate of 772,000 fish. The remainder of Late-run production was split between Birkenhead (206,000) and Weaver (333,000) stock groups. Catches of Late-run sockeye in commercial, test and marine First Nations' fisheries totalled 148,000 fish. Catches in Fraser River First Nation's and in-river recreational fisheries totalled 26,000 fish. The exploitation rate on Late-run stocks was 13%. En route mortalities, including losses of fish that migrated to a point just short of the spawning grounds but then held there until dying, were estimated at 716,000 fish.

Table 11. Catches, escapements, en route losses, run sizes and exploitation rates for Fraser River sockeye (by stock group) and pink salmon in 1999.

Stock Group	Gross Escapement: River & Ocean Catch *	Gross Escapement: In-river Indian & Sport Catch	Gross Escapement: Spawning Escapement	Gross Escapement: Difference** Between Estimates	Run Size: Adult	Run Size: Jacks	Portion of Run	Adult Exploitation Rate: River & Ocean	Adult Exploitation Rate: All Areas
Sockeye Salmon									
Early Stuart	4,000	3,000	25,000	139,000	171,000	0	5%	2%	4%
Early Summer-run									
Fennell/Nahatlatch	3,000	12,000	8,000	35,000	58,000	0	2%	5%	26%
Nadi./Gates/Pitt/Raft	9,000	32,000	58,000	95,000	194,000	400	5%	5%	21%
Seym./Scot./Bowr.	5,000	20,000	37,000	70,000	132,000	0	4%	4%	19%
Total	17,000	64,000	103,000	200,000	384,000	400	11%	4%	21%
Summer-run									
Chilko	80,000	101,000	893,000	51,000	1,125,000	400	31%	7%	16%
Quesnel	21,000	33,000	189,000	88,000	331,000	0	9%	6%	16%
L.Stuart/Stellako	20,000	43,000	200,000	55,000	318,000	600	9%	6%	20%
Total	121,000	177,000	1,282,000	194,000	1,774,000	1,000	49%	7%	17%
Late-run									
Birkenhead/Cultus	21,000	2,000	62,000	121,000	206,000	800	6%	10%	11%
Adams/L. Shuswap	87,000	13,000	309,000	363,000	772,000	0	21%	11%	13%
Weaver/Portage/Misc.	40,000	11,000	50,000	232,000	333,000	500	9%	12%	15%
Total	148,000	26,000	421,000	716,000	1,311,000	1,300	36%	11%	13%
Total Adults	290,000	270,000	1,831,000	1,249,000	3,640,000	2,700	100%	8%	15%
Total Jacks	300	0	2,400	0	2,700				
Total	290,300	270,000	1,833,400	1,249,000	3,642,700				
Portion of Total Run	8%	7%	50%	34%	100%				
Pink Salmon									
Total	92,000	71,000	3,453,000	-	3,616,000			3%	5%
Portion of Total Run	3%	2%	95%	-	100%				

* Includes catches in all fisheries, excluding Fraser River Aboriginal fisheries and recreational fisheries above Mission.

** Differences between gross escapement estimates are the lower river estimates (Mission + IF catch, PSC) minus the up-river estimates (spawning escapement + IF catch, DFO).

The total return of adult Fraser River sockeye in 1999 was estimated to be 3,640,000 fish (Table 11). Catches in all fisheries accounted for 15% of the fish while 85% of the fish were available for spawning escapement. However, estimated spawning escapements totalled only 1,831,000 adults, or 50% of the total return. The remaining 1,249,000 fish (34%) were not accounted for in upstream catch and escapement, likely due to en route mortalities caused by difficult migration conditions and disease. Of the 15% harvest component, commercial fisheries harvested 2%, miscellaneous non-commercial fisheries (including test fisheries) harvested 3%, marine First Nations' fisheries took 3% and Fraser River First Nations' fisheries accounted for approximately 7% (Table 3).

B. Pink Salmon

Catches of Fraser River pink salmon harvested in mixed stock fisheries have been estimated using GSI (genetic stock identification) techniques since 1987. The GSI program relies on genetic differences among stocks of pink salmon, expressed as different enzyme phenotypes in their body tissues. Pink salmon that spawn in Washington and British Columbia have been sampled and their

tissues (muscle, heart, liver and eye) analyzed for allelic variation at several enzymatic sites via protein electrophoresis. These genetic data have been compiled into baselines that profile the genetic characteristics of each pink salmon stock. During the in-season management period, muscle tissue samples from approximately 150 pink salmon were collected weekly from fisheries of interest. After electrophoretic screening of the tissue samples, the results were analyzed using a maximum likelihood (MLE) model. The model compares known genetic standards (from baseline samples) to genetic data from samples of unknown stock composition (from in-season, mixed-stock fishery samples) and generates estimates of the most likely stock composition.

In 1999, there were no large-scale Canadian and United States commercial fisheries directed at Fraser River pink salmon. Consequently, the GSI sampling program was reduced substantially from previous years. In prior years, the primary application of the GSI data was in the allocation of catches between countries. In 1999, however, due to the lack of commercial fishing, one of the chief goals of the program was to monitor the migration (abundance, stock proportions and timing) of Fraser River pink salmon through Johnstone and Juan de Fuca Straits. GSI samples were collected weekly from purse seine test fisheries in Johnstone Strait (Area 12) and Juan de Fuca Strait (Area 20) during the period of peak Fraser River pink salmon migration (mid-August to mid-September).

The contribution of Fraser pink salmon in GSI samples collected from the Area 12-3 purse seine test fishery increased steadily from approximately 55% in mid August to 85% by early September. Fraser pink salmon dominated (83%) the pink salmon run in Juan de Fuca Strait over the same period, based on samples collected from the Area 20 purse seine test fishery. The high proportions of Fraser pink salmon relative to co-migrating Puget Sound and Canadian non-Fraser stocks was generally consistent with GSI analyses in prior years.

The extremely low catches of pink salmon in the few commercial fisheries that occurred in 1999 precluded the need to obtain GSI samples for catch allocation purposes. Most historical harvests of Fraser pink salmon in Canadian and United States commercial fisheries occurred south of Cape Caution between mid August and mid September. In 1999, however, commercial catches of Fraser River pink salmon in marine areas totalled only 10,000 fish.

Catches and escapements of Fraser River pink salmon are shown in Tables 6 and 11.

VIII. ESCAPEMENT

Fisheries and Oceans Canada estimates the annual escapements of sockeye salmon to individual spawning grounds in the Fraser River watershed (Figure 9) and of total pink salmon to the Fraser River. These data, along with biological samples from spawners, are provided to the Commission so that PSC staff can revise in-season racial analyses, estimate total production for each stock and assess Commission programs for stock monitoring.

A. Sockeye Salmon

Sockeye salmon escapements to spawning grounds in the Fraser River watershed totalled 1,833,000 fish, including 1,830,000 adults (4- and 5-year-old fish) and 2,500 jacks (3-year-old fish) (Appendix D: Table 13). The 1999 escapement was 6% larger than the 1995 escapement of 1,731,000 adult sockeye and was the second largest recorded on the cycle. Recent cycle year escapements have varied from 965,000 to 3,306,000 adult sockeye (Table 12) and averaged 1,946,000 fish. The 1999 spawning escapement was expected to be substantially larger than observed, based on in-season Mission escapement estimates. However, severe losses of about 1,251,000 fish (139,000 Early Stuart, 200,000 Early Summer, 194,000 Summer and 716,000 Late-run sockeye; Table 11) from en route mortality reduced the effective spawning populations.

Table 12. Adult sockeye salmon escapements by run on the 1999 cycle for years 1983-1999.

	Spawning Escapement				
Run	1983	1987	1991	1995	1999
Early Stuart	24,000	148,000	141,000	123,000	25,000
Early Summer	102,000	200,000	271,000	161,000	103,000
Summer	511,000	659,000	1,256,000	926,000	1,282,000
Late	328,000	889,000	1,638,000	521,000	421,000
Adults	965,000	1,896,000	3,306,000	1,731,000	1,831,000

While there was an increase in total adult sockeye escapement compared to the brood year, the increase was confined to the Summer run. Early Stuart escapement declined from 123,000 fish to 25,000, an 80% drop. Early Summer sockeye declined 37% to 103,000 fish from 161,000 in 1995. Escapements of Early Summer sockeye to upper Fraser tributaries, however, declined more dramatically (59%) from 156,000 in 1995 to 64,000 in 1999. Summer-run spawning escapements increased 38% to 1,282,000 fish, the largest recorded on the cycle. Late-run sockeye escapements decreased 19% to 421,000 compared to 521,000 in 1995.

Sockeye escapements to Early Stuart spawning streams (A; Figure 9) declined severely due to en route mortality caused by high river discharge during migration. In total, 25,000 fish reached their natal streams to spawn. However, not only was the number lower than expected, but male sockeye comprised 61% of the successful migrants. Of the female spawners, 15.4% died before spawning, presumably from stress during migration. The estimate of 8,100 effective (i.e., successful) female spawners was the lowest on record since 1982.

Early Stuart escapements are typically concentrated in Middle River tributary streams. In 1999, 67% of the escapement spawned in these streams compared to 62% in the brood year.

Late Stuart sockeye fared much better with an escapement of 62,000 fish compared to 34,000 in the brood year. The majority of these fish spawned in Tachie River (44,000) and Middle River (8,600), although sizeable numbers were recorded in Kuzkwa and Pinchi Creeks.

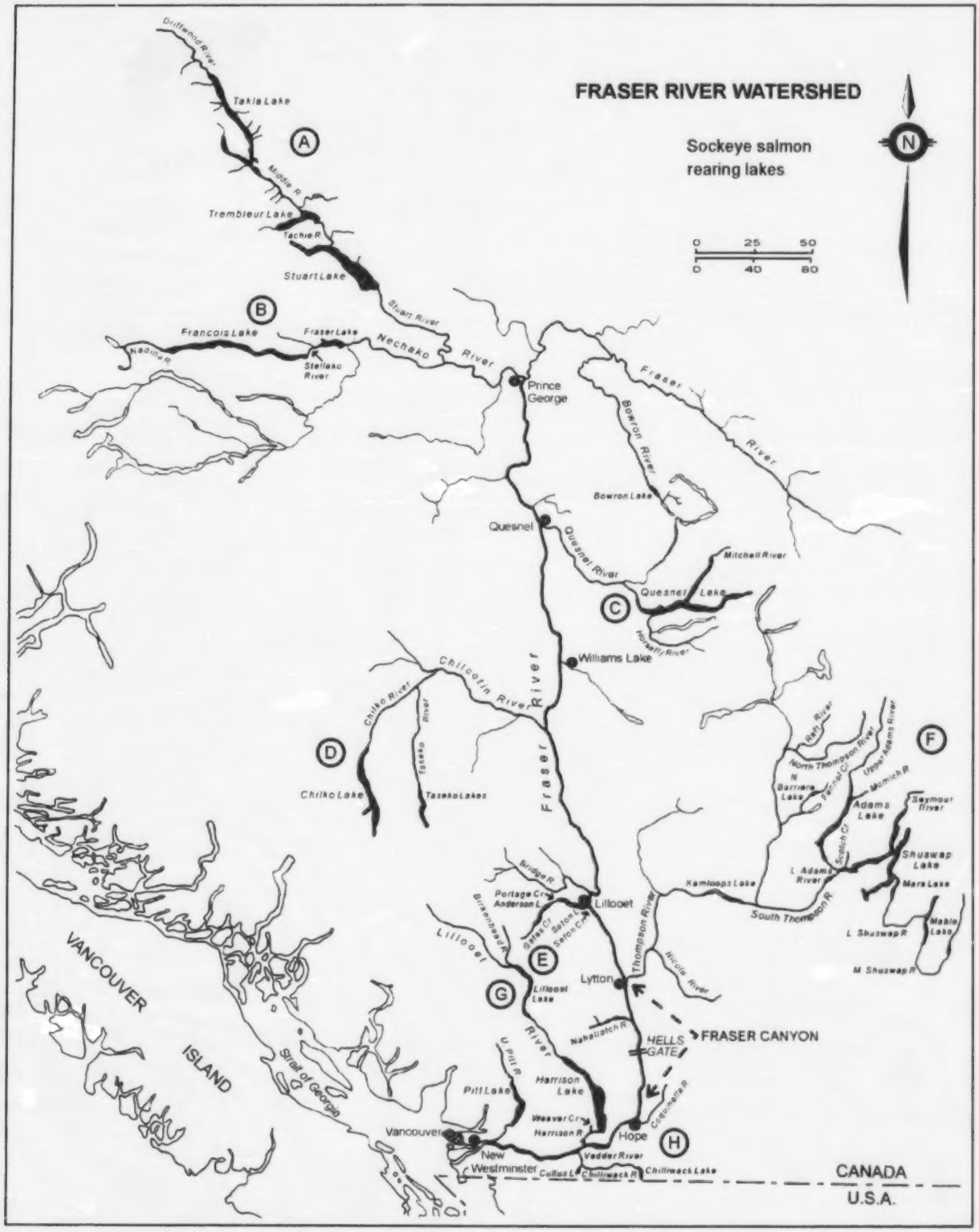

Figure 9. Sockeye salmon spawning grounds in the Fraser River watershed.

In the Nechako River system (B; Figure 9), escapements of early-timed Nadina sockeye declined 57% from 24,000 fish in 1995 to 10,000 in 1999. The later-timed Stellako River escapement of 138,000 fish was only 2% lower than in the brood year. The Stellako spawning population was approximately 40% age 5 fish from the 1994 brood that migrated to sea in 1996. This was unusually high for the cycle and attests to the low survival of smolts that went to sea in 1997.

Quesnel Lake stocks (C; Figure 9) showed strong spawning populations for a second consecutive year on this cycle (Appendix D; Table 13). An estimated 189,000 adult sockeye arrived in 1999 compared to 214,000 in 1995. Approximately 70% of the fish, however, were age 5 adults from the 1994 brood. The poor return of age 4 fish was experienced by several other stocks in the watershed. Escapement to the Horsefly River totalled 141,000 fish, while 46,000 arrived at Mitchell River. Success of spawning was good at 92%.

Escapements of Chilko River and Lake area (D; Figure 9) sockeye comprised 49% of the Fraser total in 1999. An estimated 892,000 fish escaped to spawn, a 78% increase over 1995. The 1999 escapement was the fourth consecutive escapement larger than 880,000 adult spawners. In only three previous years since 1938 (1963, 1990 and 1991) did escapements equal or exceed those observed in each of the past four years (1996-1999).

Travel times for Chilko sockeye between Mission and the Henry's Bridge counting site (10 km downstream of the spawning area) were approximately 23-26 days in 1999, compared to an average of 18-19 days in years of average discharge in the Fraser system. The high water levels in 1999 delayed the migration of Chilko sockeye, but did not affect the success of spawning. An estimated 96% of females spawned successfully.

Sockeye escapements to the Seton-Anderson system (E; Figure 9) declined in 1999. Gates Creek sockeye abundance was 4,100 adults compared to 7,200 in 1995. Of this total, 4,000 entered the spawning channel. Spawning success was low at 63%. Portage Creek sockeye escapement decreased 20% from 7,900 to 6,300 fish. The myxosporean parasite that affected other Late-run migrants caused a heavy loss at Portage Creek, as well. Success of spawning was estimated at 66%.

Thompson River sockeye stocks (F; Figure 9) normally produce well on the 1999 cycle line. Sockeye escapements to the North Thompson watershed were marginally higher than in 1995. The Fennell Creek stock decreased from 11,200 to 5,700 fish, but the Raft River population increased sharply from 1,000 to 7,000 fish. While Fennell sockeye were primarily (76%) 4-year-old fish, Raft River sockeye showed a high proportion (50%) of 5-year-old sockeye from the 1994 brood and even a few (2%) 6-year-old fish from the 1993 brood.

South Thompson River sockeye are divided into Early Summer (e.g., Seymour and Scotch) and Late-run stocks (e.g. Adams River). The Early Summer spawning population amounted to 29,000 fish compared to 74,000 in 1995. Particularly severe declines were observed at Seymour River (19,000 vs. 52,000) and Scotch Creek (4,100 vs. 15,000). Low production of 4-year-old fish and poor upstream migration conditions for adults in the Fraser and Thompson Rivers appear to have contributed to these declines. However, spawning success for these stocks was high at 97%.

Escapements of Late-run Adams River sockeye and associated stocks in the South Thompson River system also declined in 1999. An estimated 309,000 adult sockeye arrived at the spawning grounds compared to 412,000 in 1995. While the decline in numbers was less severe than in the early-timed stocks, high pre-spawning mortality due to the myxosporean parasite, *Parvicapsula minibicornis*, reduced the successful spawning population. Approximately 74% of Late-run female sockeye spawned successfully, the lowest percentage on record. In addition to the sockeye that did arrive on the spawning grounds, PSC staff estimated that 363,000 Late-run fish destined for the South Thompson area died en route or in Shuswap Lake near the Adams River.

Sockeye salmon escapements to the Harrison-Lillooet system (G; Figure 9) were severely affected by the same myxosporean parasite that attacked Late-run stocks in the South Thompson system. In total, 92,000 adult sockeye spawned in the system in 1999 compared to 91,000 in 1995.

However, about 303,000 Late-run sockeye destined for spawning grounds in the Harrison-Lillooet watershed died en route. A sizeable downstream drift of carcasses was noted in the Harrison River below where Weaver Creek and Harrison River sockeye held before spawning. Numerous carcasses from the Harrison River were observed, as well, at the Mission hydroacoustic site. Scale samples showed that both Weaver and Harrison sockeye were involved in the mortality.

The escapement of Birkenhead sockeye reached 49,000 fish, compared to 39,000 in 1995. Escapements of Weaver sockeye to the spawning channel and the Creek totalled 35,000 fish compared to 34,000 in the brood year. Pre-spawning mortality losses at Birkenhead River were minor, but spawning success of Weaver females was only 70% . On the other hand, Harrison River sockeye showed a reduced spawning population (8,600 vs. 16,600), but very little pre-spawning mortality was observed on the spawning grounds.

Lower Fraser tributaries (H; Figure 9) showed greatly variable escapements compared to 1995. The Upper Pitt River population (Early Summer run) was estimated at 36,000 sockeye compared to 5,500 in 1995. However, 77% of Pitt sockeye were age 5 sockeye from the 1994 brood. Escapements of Nahatlatch sockeye, another Early Summer stock, increased to 2,600 from 2,300 in 1995, but again over 50% of the run were age 5 fish. Late-run Cultus Lake sockeye appear to have suffered high mortality due to the myxosporean parasite discussed above. Although 12,400 sockeye entered Cultus Lake (weir count), DFO crews observed no spawned-out carcasses at the portion of the lake used for spawning.

Spawning success for the Fraser River watershed as a whole amounted to 90% of the female population. Approximately, 866,000 female sockeye salmon successfully spawned in 1999 compared to 861,000 in 1995. As noted, particularly severe pre-spawning mortality losses were observed at Gates Creek, Adams River, Weaver Creek and Cultus Lake. Mortality at the latter three locations was associated with the outbreak of the myxosporean parasite, *Parvicapsula minibicornis*.

B. Pink Salmon

In 1999, DFO obtained a single estimate of pink salmon spawning abundance for the Fraser watershed. The enumeration program was limited to tagging fish in the lower river at Duncan Bar and recovering fish at Strawberry Island by beach seines and gillnets. These data generated untagged:tagged ratios that were used to estimate total pink salmon escapement. The 1999 estimate of Fraser River pink salmon spawning abundance was 3,453,000 fish. Historical pink salmon escapements are shown in Appendix D (Table 14).

IX. ACHIEVEMENT OF OBJECTIVES

The mandate of the Fraser River Panel is to manage commercial fisheries in Panel Area waters to achieve a hierarchy of annual goals. In order of importance, these goals are as follows: a) achieve escapement targets for Fraser River sockeye and pink salmon that are set by Canada or modified by Panel agreement; b) achieve international sharing of the TAC as per the Treaty or agreement of the Parties; and c) achieve domestic catch allocation goals within each country. In the process of achieving these objectives, the Panel must consider the conservation concerns for other stocks and species of salmon when planning and conducting the fisheries. Panel management strategies are assessed after each season to determine whether the goals were met and to improve management techniques and data collection programs.

A. Gross Escapement

The Panel's first task is to achieve Canada's gross escapement targets by run-timing group (Early Stuart, Early Summer, Summer and Late). Gross escapement targets include fish for spawning and for First Nation's harvest in the Fraser River. A third category, "Management Adjustments", has been added to gross escapement targets in recent years to ensure spawning escapement targets are reached. Calculation of these adjustments comes from either: a) bias in the relationship between gross escapement estimates in the lower river (Mission escapement estimate + Fraser First Nations' catch below Mission) and estimates made upstream (First Nations' catch + spawning escapement), or b) in-season predictions of en route or pre-spawning mortality rates. On July 15, the Panel agreed to a Management Adjustment of 13,000 Early Stuart and 75,000 Early Summer fish to compensate for the tendency for in-season gross escapement estimates to be greater than upriver estimates for these run-timing groups.

The success of Panel management can be assessed by: a) whether in-season lower-river estimates of gross escapement met the adjusted gross escapement targets, and b) whether upriver gross escapement estimates (First Nations' catch + spawning escapement) met the unadjusted targets (see Management Action, Table 1). By the first measure, adjusted gross escapement targets were similar to or exceeded lower river estimates (Table 13). The summed gross escapements exceeded the target by a total of 696,000 fish. Most of these were Summer-run (96,000) and Late-run (603,000) sockeye. The Early Stuart escapement was the same as the adjusted target, while escapements of Early Summer sockeye were 3,000 fish lower than the target.

Table 13. Comparison of in-season adjusted targets and in-season lower-river gross escapement estimates for Fraser River sockeye salmon in 1999.

	Gross Escapement					
Run	In-season Target	+	Adjustment*	=	Adjusted Target	In-season Estimate**	Difference
Early Stuart	133,000		13,000		146,000	146,000	0
Early Summer	373,000		75,000		448,000	445,000	(3,000)
Summer	1,170,000		0		1,170,000	1,266,000	96,000
Late	892,000		0		892,000	1,495,000	603,000
Adults	2,568,000		88,000		2,656,000	3,352,000	696,000

* Panel-agreed gross escapement adjustment.

** Includes 42,000 sockeye salmon caught in Fraser River Indian fisheries below Mission, B.C.

In contrast, upriver estimates of gross escapement were significantly below the unadjusted targets for Early Stuart, Early Summer and Late-run sockeye, but were above the target for Summer-run stocks (Table 14). In total, the upriver estimate of gross escapement was 467,000 fish less than the in-season target. The shortfalls in the Early Stuart, Early Summer and Late-run stock

groups were largely due to large en route mortalities, as discussed in the Introduction section. Differences between in-season and post-season estimates of racial composition were also factors.

Table 14. Comparison of in-season unadjusted targets and upriver gross escapement estimates for Fraser River sockeye salmon in 1999.

	Gross Escapement		
Run	In-season Target	Upriver Estimate*	Difference
Early Stuart	133,000	28,000	(105,000)
Early Summer	373,000	167,000	(206,000)
Summer	1,170,000	1,459,000	289,000
Late	892,000	447,000 **	(445,000)
Adults	2,568,000	2,101,000	(467,000)

* Reported spawning escapements plus Fraser River First Nations and recreational fishery catches.

** Includes ESSR harvest of 5,000 Weaver sockeye.

For Fraser River pink salmon, the pre-season gross escapement target (6,000,000 fish) was unchanged during the fishing season. In-season estimates of run size were compatible with this target, but post-season estimates of run size (3,616,000 fish) based primarily on tag recovery data were much lower. There was an extremely small catch of Fraser River pink salmon in 1999, so the large shortfall in escapement relative to the in-season target was due to fewer fish than forecast returning to the river and not due to Panel action.

B. International Allocation

The Panel's second priority is to achieve the goals for international allocation of the TAC, which is based on in-season estimates of run abundance. Achievement of such goals in 1999 was severely impacted by almost complete closures of traditional commercial fisheries.

The final estimate of Washington catch was 20,000 sockeye (9.8%) compared to an allocation target of 46,000 (22.4%), out of a total international TAC of 205,000 fish (Table 15). This represents a shortfall of 26,000 fish in the United States catch. Canadian fishers caught 164,000 sockeye (80.0%), excluding catches in Fraser River First Nations' fisheries (252,000).

With respect to Fraser River pink salmon, the final estimate of Washington catch was 17,000 fish (11.5%) compared to an allocation target of 38,000 (25.7%), out of an international TAC of 148,000 fish (Table 15). The resulting shortfall in the United States catch was 21,000 fish. Canadian fishers caught 131,000 fish (88.5% of the TAC). Catches of Fraser River pink salmon by both countries were incidental in nature - directed fisheries on pink salmon were not pursued in 1999.

Table 15. Preliminary calculations of total allowable catch and international shares of Fraser River sockeye salmon in 1999.

		Sockeye	Pink
TOTAL ALLOWABLE CATCH			
Total Run Size		3,643,000	3,616,000
Deductions			
Escapement		1,833,000	3,453,000
Difference Between Estimates		1,249,000	-
ESSR Fishery Catches	*	5,000	-
Fraser River Aboriginal Fishery Exemption		252,000	-
Test Fishing		99,000	15,000
Total Deductions:		3,438,000	3,468,000
Total Allowable Catch:		205,000	148,000
UNITED STATES			
Washington Catch		20,000	17,000
Washington Share **		46,000	38,000
Deviation:		(26,000)	(21,000)
Alaska Catch		21,000	0
Total United States Catch:		41,000	17,000
CANADA			
Canadian Catch - Aboriginal Fishery Exemption		164,000	131,000
Canadian Share		138,000	110,000
Deviation:		26,000	21,000

* Terminal catch of Weaver sockeye taken under contract for an Excess Salmon to Spawning Requirements (ESSR) fishery.

** Washington allocations of the TAC according to Annex IV of the Pacific Salmon Treaty were 22.4% Fraser sockeye and 25.7% Fraser pinks.

C. Domestic Allocation

The third priority of the Panel is to achieve the domestic allocation goals of the Parties. The Panel's ability to achieve such goals is limited because the Panel manages only those fisheries in Panel Areas that are directed at Fraser River sockeye and pink salmon. In 1999, the possibility of achieving domestic goals with any degree of success was precluded by extensive restrictions of all commercial fisheries in both countries. Canadian net fisheries in non-Panel areas such as Johnstone Strait and all fisheries north of Vancouver Island were regulated by Canada.

In 1999, allocation goals existed between Treaty Indian and Non-Indian user groups in Washington, and within each of these groups as well. The goals are compared to actual catches in Table 16. In short, only Treaty Indian fishers in Areas 4B, 5 and 6C were provided fishing opportunities in 1999. The reason for this were the extensive fishery closures, due to a much lower than anticipated abundance of returning Fraser sockeye and expected large en route and pre-spawning mortalities. Thus, allocation targets for Washington fisheries could not be obtained.

Domestic allocation goals in Canada could not be achieved for the same reason. Canadian goals and actual catches are shown in Table 17.

Table 16. Preliminary estimates of domestic overages and underages s in Washington catches of Fraser River sockeye salmon in 1999.

User Category	Actual Catches Fish	%	Catch Goals Fish	%		Overage/ (Underage)
Treaty Indians: by Area						
Treaty Indian						
Areas 4B, 5 and 6C	20,000	100.0%	4,000	20.0%	% *	16,000
Areas 6, 7 and 7A	0	0.0%	16,000	80.0%	%	(16,000)
Total:	20,000	100.0%	20,000	100.0%	%	0
Non-Indians: by Gear						
Purse Seine	0	0.0%	0	54.0%	%	0
Gillnet	0	0.0%	0	41.0%	%	0
Reefnet	0	0.0%	0	5.0%	%	0
Total:	0	0.0%	0	100.0%	%	0
Washington: between Treaty Indian and Non-Indian Users						
Treaty Indian	20,000	100.0%	10,000 *	50.0%	%	10,000
Non-Indian	0	0.0%	10,000 *	50.0%	%	(10,000)
Washington Total:	20,000	100.0%	20,000	100.0%	%	0

* Maximum percentage share.

Table 17. Preliminary estimates of domestic overages and underages in C n Canadian catches of Fraser River sockeye salmon in 1999.

Gear License Area	Actual Catches Fish	%	Catch Goals Fish	%		Overage/ (Underage)
Purse Seine						
A Northern	0	0.0%	0	0.0%	%	0
B Southern	1,000	2.0%	22,000	44.0%	%	(21,000)
Total	1,000	2.0%	22,000	44.0%	%	(21,000)
Gillnet						
D Johnstone Strait	35,000	71.4%	5,000	10.0%	%	30,000
E Fraser River	0	0.0%	10,000	20.0%	%	(10,000)
Total	35,000	71.4%	15,000	30.0%	%	20,000
Troll						
F Northern	0	0.0%	1,000	2.0%	% *	(1,000)
G Southern	2,000	4.1%	8,000	16.0%	%	(6,000)
H Inside	11,000	22.4%	4,000	8.0%	%	7,000
Total	13,000	26.5%	13,000	26.0%	%	0
Total	49,000	100.0%	50,000	100.0%	%	

* Ceiling of 68,000 sockeye for Area F troll allocation.

D. Conservation of Other Stocks

Due to the very restricted fishing in Canadian and United States Panel Area waters, catches of non-target species and stocks in fisheries directed at Fraser River sockeye were very low (Table 18).

Table 18. Preliminary estimates of catches of non-Fraser sockeye and pink salmon and of other salmon species in commercial fisheries regulated by the Fraser River Panel in 1999.*

	Non-Fraser		Fraser and Non-Fraser			
Area and Gear	Sockeye	Pink	Chinook	Coho	Chum	Steelhead
Areas 4B, 5 and 6C Net	0	1,100	500	1,000	0	-
Areas 6, 7 and 7A Net	0	0	0	0	0	-
Total	0	1,100	500	1,000	0	0
Area 20 Net	0	0	0	0	0	-
Area 29 Net	0	0	0	0	0	-
Total	0	0	0	0	0	0
Total	0	1,100	500	1,000	0	0

* Estimates are provided by the WDFW and DFO.

X. ALLOCATION STATUS

In accordance with the payback policy in the renewed Annex IV of the Treaty, catch overages and underages will be used to adjust United States allocations in subsequent years. After the 1999 fishing season, the United States has a catch shortfall of 26,000 Fraser sockeye and 21,000 pink salmon.

XI. APPENDICES

APPENDIX A: PRE-SEASON FORECASTS AND SPAWNING ESCAPEMENT TARGETS FOR FRASER RIVER SOCKEYE SALMON IN 1999.

Table 1. Pre-season forecasts and spawning escapement targets for Fraser River sockeye salmon. (Provided to the Panel by Fisheries and Oceans Canada on July 6, 1999).

Run	Forecast Return	Spawning Escapement Target
	Sockeye Salmon	
Early Stuart	318,000	150,000
Early Summer	477,000	260,000
Summer	5,328,000	1,489,000
Late	2,125,000	788,000
Total Adult	8,248,000	2,687,000
	Pink Salmon	
Total Pink Return	8,148,000	6,000,000

Table 2. Preliminary Fraser River sockeye salmon escapement target plan (in thousands of fish) for 1999. (Provided to the Panel by Fisheries and Oceans Canada).

Run	Stock group	Forecast Return (*a*)	Range of returns	Escapement target		Harvest rate plan	
Early Stuart			0 - 66	0 - 66		0%	
			67 - 176	-		Max 15%	
		318	177 - 429	150		15 to 65%	
			430 - 1,040	-		65-70%	
			>1,040	364	*b*	>65%	*d*
Early Summer			0 - 306	-	*c*	Max 15%	
		477	307 - 743	260	*c*	15 to 65%	
			744 - 1,486	-	*c*	65-70%	
			>1,486	520	*b*	>65%	*d*
Summer		5,328		1,489			
	Chilko		0 - 588	-		Max 15%	
			589 - 1,667	500		15 to 70%	
			1,668 - 2,747	-		70%	*d*
		2,949	>2,747	824		>70%	*d*
	Stellako/ Late Stuart/ Quesnel	2,379		665			
Late		2,125		788			
	Adams/Shuswap		0 - 706	-		Max 15%	
		1,619	707 - 1,714	600	*f*	15 to 65%	*d*
			1,715 - 2,571	-	*f*	65 to 75%	*d*
			2,572 - 2,999	900	*f*	65 to 75%	*d*
			3,000 - 13,000	-		70%	*d*
			>13,000	4,550	*b*	>70%	*d*
	Birkenhead	229		85	*g*		
	Weaver et. al.	277		103	*g*		
Totals		8,248		2,687		67%	
Fraser Pink Salmon		8,148		6,000	*h*		

a Point estimates with a 50% probability of estimated runs being less than or greater than specified.

b Interim goal plus 30%.

c Achievement of Early Summer targets may be constrained by higher priority targets for Early Stuart and Summer run stock groups.

d Maximum harvest rate dependent on in-season estimates of co-migrating stocks and species.

e Targets dependent on resultant harvest rates to achieve a priority for the Chilko stock.

f Achievement of the Adams/Shuswap target may be constrained to a minimum of 600,000 to achieve a higher priority target for the Chilko stock.

g Targets dependent on resultant harvest rates to achieve a priority for the Adams/Shuswap stock complex.

h Targets dependent on resultant harvest rates to achieve a priority for sockeye.

APPENDIX B: 1999 REGULATIONS

The Fraser River Panel approved regulations for the management of the Fraser River sockeye and pink salmon fishery in Panel Area waters and submitted these to the Pacific Salmon Commission. The Commission approved the Fishery Regime and Regulations and submitted these to the respective national governments for approval on June 29, 1999.

Canadian Fraser River Panel Area

In accordance with Article VI, Paragraph 5 of the Pacific Salmon Treaty (and the 1998 Agreement), the Commission recommends to Canada the adoption of the following Fishing Regime developed by the Fraser River Panel, as per Annex IV, Chapter 4 (1) (d) of the Treaty, namely:

1. a) No person shall commercially fish for sockeye or pink salmon in Pacific Fishery Management Area 20-1, 3 and 4 with nets from the 4th day of July, 1999, to the 18th day of September, 1999, both dates inclusive.

   b) No person shall troll commercially for sockeye or pink salmon in Pacific Fishery Management Area 20-1, 3 and 4 from the 4th day of July, 1999, to the 18th day of September, 1999, both dates inclusive.

2. a) No person shall commercially fish for sockeye or pink salmon in Pacific Fishery Management Areas 17 and 18 with nets from the 4th day of July, 1999, to the 25th day of September, 1999, both dates inclusive.

   b) No person shall troll commercially for sockeye or pink salmon in Pacific Fishery Management Area 18-1, 4 and 11 from the 4th day of July, 1999, to the 25th day of September, 1999, both dates inclusive.

3. a) No person shall commercially fish for sockeye or pink salmon with nets in Pacific Fishery Management Area 29 from the 4th day of July, 1999, to the 16th day of October, 1999, both dates inclusive.

   b) No person shall troll commercially for sockeye or pink salmon in Pacific Fishery Management Area 29 from the 4th day of July, 1999, to the 16th day of October, 1999, both dates inclusive.

4. The following Fraser River Panel Area waters are excluded:

   a) High Seas westerly of the Bonilla Point-Tatoosh Island Lighthouse Line.

   b) Pacific Fishery Management Area 19, Area 20-2 and 5 to 7 and Area 29-8.

   c) Commercial troll fishing in Pacific Fishery Management Area 17, Area 18-2, 3 and 5 to 10.

During the 1999 season, the Fraser River Panel will adopt Orders establishing open fishing periods based on the attached 1999 Management Plan adopted on June 29, 1999 by the Panel. This Plan is designed to achieve Pacific Salmon Treaty-mandated international allocations of the catch and domestic goals of the Parties.

United States Fraser River Panel Area

In accordance with Article VI, Paragraph 5 of the Pacific Salmon Treaty, the Commission recommends to the United States Government the adoption of the following Fishing Regime developed by the Fraser River Panel as per Annex IV, Chapter 4 (1) (d) of the Treaty, namely:

Treaty Indian Fisheries:

1. No Treaty Indian shall commercially fish for sockeye or pink salmon in Puget Sound Salmon Management and Catch Reporting Areas 4B, 5 and 6C with drift gillnets or purse seines from the 4th day of July, 1999 to the 18th day of September, 1999, both dates inclusive.

2. No Treaty Indian shall commercially fish for sockeye or pink salmon in Puget Sound Salmon Management and Catch Reporting Areas 6, 6A, 7 and 7A with nets from the 4th day of July, 1999, to the 25th day of September, 1999, both dates inclusive.

3. No Treaty Indian shall commercially fish for sockeye or pink salmon with nets in that portion of Puget Sound Salmon Management and Catch Reporting Area 7A lying westerly of a straight line drawn from the low water range marker in Boundary Bay on the International Boundary through the east tip of Point Roberts in the State of Washington to the East Point Light on Saturna Island in the Province of British Columbia from the 26th day of September, 1999, to the 2nd day of October, 1999, both dates inclusive.

All-Citizen Fisheries:

1. No person shall fish for sockeye or pink salmon in Puget Sound Salmon Management and Catch Reporting Areas 4B, 5, and 6C with nets from the 4th day of July, 1999, to the 18th day of September, 1999, both dates inclusive.

2. No person shall fish for sockeye or pink salmon in Puget Sound Salmon Management and Catch Reporting Areas 6, 6A, 7 and 7A with nets from the 4th day of July, 1999, to the 25th day of September, 1999, both dates inclusive.

3. No person shall fish for sockeye or pink salmon with nets in that portion of Puget Sound Salmon Management and Catch Reporting Area 7A lying westerly of a straight line drawn from the low water range marker in Boundary Bay on the International Boundary through the east tip of Point Roberts in the State of Washington to the East Point Light on Saturna Island in the Province of British Columbia from the 26th day of September, 1999, to the 2nd day of October, 1999, both dates inclusive.

The following Fraser River Panel Area waters and fisheries are excluded:

Treaty Indian and All-Citizen Fisheries:

1. Coastal Salmon Management and Catch Reporting Area 4 and that Part of Area 3 north of 48°N. latitude (Carroll Island).

2. Puget Sound Salmon Management and Catch Reporting Areas 6B, 6D, 7B, 7C, 7D and 7E.

During the 1999 season, the Fraser River Panel will adopt Orders establishing open fishing periods based on the attached 1999 Management Plan adopted on June 29, 1999 by the Panel. This Plan is designed to achieve Pacific Salmon Treaty-mandated international allocations of the catch and domestic goals of the Parties.

APPENDIX C: 1999 FRASER RIVER PANEL IN-SEASON ORDERS

To provide for adequate escapement of the various stocks of Fraser River sockeye and pink salmon and for the prescribed allocation of catch (a) internationally, between the United States and Canada and (b) domestically, among the commercial user groups in Canada and the United States, the Fraser River Panel formulated the following orders to regulate Panel Area fisheries in 1999.

July 23 — United States
Treaty Indian Fishery
Areas 4B, 5 and 6C:
Drift gillnets open 12:00 p.m. (noon), July 25 to 12:00 p.m. (noon), July 28.

July 27 — United States
Treaty Indian Fishery
Areas 4B, 5 and 6C:
Drift gillnet fishing extended 12:00 p.m. (noon), July 28 to 12:00 p.m. (noon), July 31.

July 30 — United States
Treaty Indian Fishery
Areas 4B, 5 and 6C:
Drift gillnets open 12:00 p.m. (noon), August 1 to 12:00 p.m. (noon), August 3.

August 2 — United States
Treaty Indian Fishery
Areas 4B, 5 and 6C:
Drift gillnet fishing extended 12:00 p.m. (noon), August 3 to 12:00 p.m. (noon), August 7.

August 6 — United States
Treaty Indian Fishery
Areas 4B, 5 and 6C:
Drift gillnet fishing closed 6:00 p.m., August 6.

September 10 — United States
Treaty Indian Fishery
Areas 4B, 5 and 6C:
Relinquish regulatory control effective, September 12.

Canada
Area 20:
Relinquish regulatory control effective, September 12.

APPENDIX D: TABLES 1-14

Table 1. Commercial net catches of Fraser River sockeye salmon in Canadian Area 20 (Juan de Fuca Strait) by week for cycle years 1987-1999.

Date *	1987	1991	1995	1999
Jun. 27-Jul. 3	0	0	0	0
Jul. 4-Jul. 10	0	0	0	0
Jul. 11-Jul. 17	0	0	0	0
Jul. 18-Jul. 24	0	0	0	0
Jul. 25-Jul. 31	0	0	0	0
Aug. 1-Aug. 7	0	52,000	0	0
Aug. 8-Aug. 14	210,000	134,000	0	0
Aug. 15-Aug. 21	124,000	0	0	0
Aug. 22-Aug. 28	124,000	801,000	15,000	0
Aug. 29-Sep. 4	5,000	285,000	43,000	0
Sep. 5-Sep. 11	0	6,000	3,000	0
Sep. 12-Sep. 18	0	0	0	0
Sep. 19-Sep. 25	0	0	0	0
Sep. 26-Oct. 2	0	0	0	0
Oct. 3-Oct. 9	0	0	0	0
Total	463,000	1,278,000	61,000	0

* Dates for 1999. For other years, data from the nearest week were used.

Table 2. Commercial net and troll catches of Fraser River sockeye salmon in Canadian Areas 17, 18, and 29 (Strait of Georgia and lower Fraser River) by week for cycle years 1987-1999.

Date *	1987	1991	1995	1999
Jun. 27-Jul. 3	0	0	0	0
Jul. 4-Jul. 10	0	125,000	0	0
Jul. 11-Jul. 17	0	0	0	0
Jul. 18-Jul. 24	0	0	0	0
Jul. 25-Jul. 31	0	118,000	0	0
Aug. 1-Aug. 7	145,000	242,000	0	1,000
Aug. 8-Aug. 14	185,000	156,000	0	0
Aug. 15-Aug. 21	180,000	17,000	54,000	0
Aug. 22-Aug. 28	38,000	152,000	88,000	0
Aug. 29-Sep. 4	62,000	19,000	45,000	0
Sep. 5-Sep. 11	13,000	63,000	0	0
Sep. 12-Sep. 18	11,000	33,000	0	0
Sep. 19-Sep. 25	0	1,000	0	0
Sep. 26-Oct. 2	0	8,000	0	0
Oct. 3-Oct. 9	0	1,000	0	0
Total	634,000	935,000	187,000	1,000

* Dates for 1999. For other years, data from the nearest week were used.

Table 3. Commercial troll landings of Fraser River sockeye salmon in Canadian Areas 121 to 127 (west coast of Vancouver Island) by week for cycle years 1987-1999.

Date *	1987	1991	1995	1999
Jun. 27-Jul. 3	0	0	0	0
Jul. 4-Jul. 10	0	0	0	0
Jul. 11-Jul. 17	0	0	0	0
Jul. 18-Jul. 24	0	0	0	0
Jul. 25-Jul. 31	0	1,000	0	0
Aug. 1-Aug. 7	10,000	29,000	8,000	1,000
Aug. 8-Aug. 14	204,000	77,000	12,000	0
Aug. 15-Aug. 21	246,000	334,000	0	0
Aug. 22-Aug. 28	4,000	929,000	11,000	0
Aug. 29-Sep. 4	0	20,000	2,000	0
Sep. 5-Sep. 11	0	0	0	0
Sep. 12-Sep. 18	0	0	0	0
Sep. 19-Sep. 25	0	2,000	0	0
Sep. 26-Oct. 2	0	0	0	0
Oct. 3-Oct. 9	0	0	0	0
Total	464,000	1,392,000	33,000	1,000

* Dates for 1999. For other years, data from the nearest week were used.

Table 4. Commercial net and troll catches of Fraser River sockeye salmon in Canadian Areas 11 to 16 (Johnstone Strait and northern Strait of Georgia) by week for cycle years 1987-1999.

Date *	1987	1991	1995	1999
Jun. 27-Jul. 3	0	0	0	0
Jul. 4-Jul. 10	0	0	0	0
Jul. 11-Jul. 17	0	0	0	0
Jul. 18-Jul. 24	1,000	0	0	0
Jul. 25-Jul. 31	0	4,000	0	23,000
Aug. 1-Aug. 7	333,000	85,000	0	20,000
Aug. 8-Aug. 14	690,000	455,000	300,000	4,000
Aug. 15-Aug. 21	363,000	876,000	0	0
Aug. 22-Aug. 28	173,000	689,000	53,000	0
Aug. 29-Sep. 4	33,000	231,000	97,000	0
Sep. 5-Sep. 11	0	15,000	24,000	0
Sep. 12-Sep. 18	0	62,000	6,000	0
Sep. 19-Sep. 25	0	1,000	0	0
Sep. 26-Oct. 2	0	2,000	0	0
Oct. 3-Oct. 9	0	0	0	0
Total	1,593,000	2,420,000	480,000	47,000

* Dates for 1999. For other years, data from the nearest week were used.

Table 5. Catches of Fraser River sockeye salmon in the Canadian Fraser River Indian fishery by area (Fraser River mainstream or tributary areas) for cycle years 1987-1999.*

Fishing Area		1987	1991	1995		1999
Fraser River Mainstem						
Below Port Mann	*1*	26,500	70,100	131,700		26,200
Port Mann to Mission	*1*	8,500	15,500	119,600		14,700
Mission to Hope		89,900	142,900	111,900		26,600
Hope to Sawmill Cr.	*2*	158,400	190,400	213,800		69,800
Sawmill Cr. to Kelly Cr.	*2*	100,300	95,000	267,500	*4*	72,800
Kelly Creek to Naver Cr.	*3*	11,600	31,200	6,900		5,800
Above Naver Cr.	*3*	2,500	5,000	2,100		3,200
Total		397,700	550,100	853,500		219,100
Tributaries						
Harrison/Lillooet System		7,700	1,806	0		0
Thompson System		3,500	300	8,200	*4*	2,600
Chilcotin System		28,100	34,600	19,200		19,800
Nechako System		22,300	11,600	3,900		6,200
Stuart System		8,700	7,600	7,400		3,800
Total		70,300	55,906	38,700		32,400
Total Catch		468,000	606,006	892,200		251,500

* Data supplied by DFO.

1 Prior to 1995, the divisions were Steveston, and Deas to Mission.

2 Prior to 1993, the divisions were Hope to North Bend, and North Bend to Churn Creek.

3 Prior to 1994, the divisions were Churn Creek to Hixon, and Above Hixon.

4 Schwarz, C.J. 1996. Analysis of the 1995 Upper Fraser River Catch Monitoring Program of First Nations Fisheries. Prepared for DFO [Vancouver, B.C.].

Table 6. Commercial net catches of Fraser River sockeye salmon in United States Areas 4B, 5, 6, 6C, 7, and 7A (Juan de Fuca Strait and northern Puget Sound) by week for cycle years 1987-1999.

Date *	1987	1991	1995	1999
Jun. 27-Jul. 3	0	0	0	0
Jul. 4-Jul. 10	0	0	0	0
Jul. 11-Jul. 17	0	43,000	2,000	0
Jul. 18-Jul. 24	0	0	0	0
Jul. 25-Jul. 31	16,000	0	8,000	7,000
Aug. 1-Aug. 7	341,000	17,000	142,000	13,000
Aug. 8-Aug. 14	355,000	126,000	12,000	0
Aug. 15-Aug. 21	853,000	659,000	74,000	0
Aug. 22-Aug. 28	278,000	564,000	134,000	0
Aug. 29-Sep. 4	93,000	139,000	14,000	0
Sep. 5-Sep. 11	0	163,000	23,000	0
Sep. 12-Sep. 18	0	78,000	0	0
Sep. 19-Sep. 25	0	27,000	0	0
Sep. 26-Oct. 2	0	1,000	0	0
Oct. 3-Oct. 9	0	0	0	0
Total	1,936,000	1,817,000	409,000	20,000

* Dates for 1999. For other years, data from the nearest week were used.

Table 7. Commercial net catches of Fraser River pink salmon in Canadian Area 20 (Juan de Fuca Strait) by week for cycle years 1993-1999.

Date *	1993	1995	1997	1999
Jun. 27-Jul. 3	0	0	0	0
Jul. 4-Jul. 10	0	0	0	0
Jul. 11-Jul. 17	0	0	0	0
Jul. 18-Jul. 24	0	0	0	0
Jul. 25-Jul. 31	6,000	0	0	0
Aug. 1-Aug. 7	18,000	0	0	0
Aug. 8-Aug. 14	0	1,000	17,000	0
Aug. 15-Aug. 21	2,000	97,000	107,000	0
Aug. 22-Aug. 28	1,000	395,000	177,000	0
Aug. 29-Sep. 4	0	203,000	0	0
Sep. 5-Sep. 11	0	4,000	0	0
Sep. 12-Sep. 18	0	0	0	0
Sep. 19-Sep. 25	0	0	0	0
Sep. 26-Oct. 2	0	0	0	0
Oct. 3-Oct. 9	0	0	0	0
Total	27,000	700,000	301,000	0

* Dates for 1999. For other years, data from the nearest week were used.

Table 8. Commercial net and troll catches of Fraser River pink salmon in Canadian Areas 17, 18, and 29 (Strait of Georgia and lower Fraser River) by week for cycle years 1993-1999.

Date *	1993	1995	1997	1999
Jun. 27-Jul. 3	0	0	0	0
Jul. 4-Jul. 10	0	0	0	0
Jul. 11-Jul. 17	0	0	0	0
Jul. 18-Jul. 24	0	0	0	0
Jul. 25-Jul. 31	1,000	0	0	0
Aug. 1-Aug. 7	1,000	0	1,000	0
Aug. 8-Aug. 14	4,000	3,000	0	0
Aug. 15-Aug. 21	0	19,000	6,000	0
Aug. 22-Aug. 28	96,000	34,000	48,000	0
Aug. 29-Sep. 4	87,000	10,000	109,000	0
Sep. 5-Sep. 11	45,000	3,000	3,000	0
Sep. 12-Sep. 18	12,000	1,000	2,000	0
Sep. 19-Sep. 25	7,000	0	0	0
Sep. 26-Oct. 2	1,000	0	0	0
Oct. 3-Oct. 9	0	0	0	0
Total	254,000	70,000	169,000	0

* Dates for 1999. For other years, data from the nearest week were used.

Table 9. Commercial troll landings of Fraser River pink salmon in Canadian Areas 121 to 127 (west coast of Vancouver Island) by week for cycle years 1993-1999.

Date *	1993	1995	1997	1999
Jun. 27-Jul. 3	0	4,000	0	0
Jul. 4-Jul. 10	0	15,000	0	0
Jul. 11-Jul. 17	4,000	27,000	0	0
Jul. 18-Jul. 24	6,000	60,000	0	0
Jul. 25-Jul. 31	12,000	4,000	0	0
Aug. 1-Aug. 7	90,000	59,000	1,000	1,000
Aug. 8-Aug. 14	72,000	3,000	1,000	0
Aug. 15-Aug. 21	36,000	149,000	5,000	0
Aug. 22-Aug. 28	52,000	195,000	2,000	0
Aug. 29-Sep. 4	35,000	50,000	2,000	0
Sep. 5-Sep. 11	34,000	4,000	0	0
Sep. 12-Sep. 18	9,000	3,000	0	0
Sep. 19-Sep. 25	8,000	0	0	0
Sep. 26-Oct. 2	0	0	0	0
Oct. 3-Oct. 9	0	0	0	0
Total	358,000	573,000	11,000	1,000

* Dates for 1999. For other years, data from the nearest week were used.

Table 10. Commercial net and troll catches of Fraser River pink salmon in Canadian Areas 11 to 16 (Johnstone Strait and northern Strait of Georgia) by week for cycle years 1993-1999.

Date *	1993	1995	1997	1999
Jun. 27-Jul. 3	0	0	0	0
Jul. 4-Jul. 10	0	0	0	0
Jul. 11-Jul. 17	0	0	0	0
Jul. 18-Jul. 24	1,000	0	0	0
Jul. 25-Jul. 31	14,000	0	37,000	0
Aug. 1-Aug. 7	279,000	58,000	152,000	2,000
Aug. 8-Aug. 14	731,000	0	319,000	0
Aug. 15-Aug. 21	56,000	277,000	297,000	0
Aug. 22-Aug. 28	1,293,000	806,000	533,000	0
Aug. 29-Sep. 4	471,000	208,000	682,000	4,000
Sep. 5-Sep. 11	72,000	187,000	572,000	0
Sep. 12-Sep. 18	105,000	15,000	342,000	0
Sep. 19-Sep. 25	4,000	4,000	60,000	0
Sep. 26-Oct. 2	0	0	9,000	0
Oct. 3-Oct. 9	0	0	4,000	0
Total	3,026,000	1,555,000	3,007,000	6,000

* Dates for 1999. For other years, data from the nearest week were used.

Table 11. Catches of Fraser River pink salmon in the Canadian Fraser River Indian fishery by area (Fraser River mainstream or tributary areas) for cycle years 1993-1999.*

Fishing Area		1993	1995	1997	1999
Fraser River Mainstem					
Below Port Mann	*1*	5,900	28,500	2,200	5,500
Port Mann to Mission	*1*	4,800	32,400	4,200	200
Mission to Hope		4,100	50,900	14,700	2,700
Hope to Sawmill Cr.	*2*	1,300	37,200	6,600	300
Sawmill Cr. to Kelly Cr.	*2*	1,000	5,100	900	0
Kelly Creek to Naver Cr.	*3*	0	0	0	0
Above Naver Cr.	*3*	0	0	0	0
Total		17,100	154,100	28,600	8,700
Tributaries					
Harrison/Lillooet System		0	0	0	0
Thompson System		0	400	0	0
Chilcotin System		0	0	0	0
Nechako System		0	0	0	0
Stuart System		0	0	0	0
Total		0	400	0	0
Total Catch		17,100	154,500	28,600	8,700

* Data supplied by DFO.

1 Prior to 1995, the divisions were Steveston, and Deas to Mission.

2 Prior to 1993, the divisions were Hope to North Bend, and North Bend to Churn Creek.

3 Prior to 1994, the divisions were Churn Creek to Hixon, and Above Hixon.

Table 12. Commercial net catches of Fraser River pink salmon in United States Areas 4B, 5, 6, 6C, 7, and 7A (Juan de Fuca Strait and northern Puget Sound) by week for cycle years 1993-1999.

Date *	1993	1995	1997	1999
Jun. 27-Jul. 3	0	0	0	0
Jul. 4-Jul. 10	0	0	0	0
Jul. 11-Jul. 17	0	0	0	0
Jul. 18-Jul. 24	0	2,000	1,000	0
Jul. 25-Jul. 31	14,000	21,000	2,000	1,000
Aug. 1-Aug. 7	62,000	6,000	4,000	2,000
Aug. 8-Aug. 14	170,000	50,000	20,000	0
Aug. 15-Aug. 21	404,000	536,000	68,000	0
Aug. 22-Aug. 28	701,000	265,000	260,000	0
Aug. 29-Sep. 4	383,000	1,096,000	596,000	0
Sep. 5-Sep. 11	0	0	536,000	0
Sep. 12-Sep. 18	0	1,000	55,000	0
Sep. 19-Sep. 25	0	0	4,000	0
Sep. 26-Oct. 2	0	0	0	0
Oct. 3-Oct. 9	0	0	0	0
Total	1,734,000	1,977,000	1,546,000	3,000

* Dates for 1999. For other years, data from the nearest week were used.

Table 13. Escapements of sockeye salmon to Fraser River spawning areas for cycle years 1983-1999.

DISTRICT	Estimated Number of Adult Sockeye *					Jacks
Stream/Lake	1983	1987	1991	1995	1999	1999
NORTHEAST						
Upper Bowron R.	6,451	11,071	4,919	34,417	8,238	0
STUART						
Early Runs						
Driftwood R.	Present	Present	2,746	4,046	183	0
Takla L. Streams	3,130	27,614	25,857	15,134	2,173	0
Middle R. Streams	18,491	100,706	81,071	76,619	17,834	0
Trembleur L. Streams	2,246	19,874	31,445	26,911	4,342	0
Early Stuart Total	23,867	148,194	141,119	122,710	24,532	0
Late Runs						
Middle R.	639	2,441	16,331	7,462	8,559	0
Tachie R.	853	2,398	50,841	22,368	44,273	497
Miscellaneous	754	1,633	9,688	4,532	8,742	49
Late Stuart Total	2,246	6,472	76,860	34,362	61,574	546
NECHAKO						
Nadina R. (Late)	3,035	7,890	5,000	2,499	3,239	1
Nadina Channel	23,841	29,734	56,074	21,499	7,099	3
Stellako R.	121,692	211,085	94,884	141,813	138,137	14
QUESNEL						
Upper Horsefly R.	1,998	14,531	14,000	178,533	133,417	0
Lower Horsefly R.	-	2,201	5,754	- *1*	- *1*	-
Horsefly Channel	-	-	18,815	- *1*	5,974	0
McKinley Cr.	38	63	0	380	943	0
Mitchell R.	119	3,751	7,690	35,190	46,451	0
Miscellaneous	-	-	-	-	2,575	0
Quesnel Total	2,155	20,546	46,259	214,103	189,360	0
CHILCOTIN						
Chilko R.	329,220	239,601	1,017,242	526,243	891,567	355
Chilko Channel	-	-	20,495	8,318	- *2*	0
Chilko L.-South End	53,613	181,414	- *2*	- *2*	- *2*	0
SETON-ANDERSON						
Gates Cr.	811	1,725	952	7,181	88	0
Gates Channel	6,573	7,692	8,088	- *3*	4,047	372
Portage Cr.	7,747	6,820	12,053	7,875	6,264	211
NORTH THOMPSON						
Raft R.	2,780	1,436	464	1,040	6,979	0
Fennell Cr.	4,977	16,633	20,466	11,235	5,697	0
SOUTH THOMPSON						
Summer Runs						
Seymour R.	29,831	84,315	128,253	51,723	18,895	0
Scotch Cr.	239	2,089	9,954	14,815	4,093	0
Anstey R.	382	2,257	5,011	3,562	2,245	0
Eagle R.	72	879	3,677	3,679	3,818	0
Late Runs						
Adams R.	201,610	567,989	1,204,153	378,903	279,424	0
Little R.	- *4*	17,998	13,500	9,125	19,345	0
Lower Shuswap R.	7,308	10,343	15,678	12,330	7,081	0
Miscellaneous	2,447	20,995	22,460	11,473	2,698	0
HARRISON-LILLOOET						
Birkenhead R.	44,029	164,849	293,626	38,588	48,916	670
Harrison R.	4,239	5,228	15,000	16,618	8,577	0
Weaver Cr.	20,727	26,272	10,179	12,832	13,520	104
Weaver Channel	18,614	33,696	27,942	21,199	21,114	100
LOWER FRASER						
Nahatlatch R. & L.	2,186	13,501	2,755	2,297	2,613	0
Cultus L.	19,944	32,184	20,157	10,316	12,392	11
Upper Pitt R.	16,852	13,637	22,500	5,500	35,961	16
MISCELLANEOUS	7,429	9,402	6,552	4,838	2,767	76
ADULTS	964,917	1,895,947	3,306,272	1,731,093	1,830,280	2,479
JACKS	10,984	18,796	35,191	20,237	2,479	
TOTAL NET ESCAPEMENT	975,901	1,914,743	3,341,463	1,751,330	1,832,759	

* 1983 data are from the PSC. Estimates for subsequent years are from DFO.

1 Included in Upper Horsefly River estimate.

2 Included in Chilko River estimate.

3 Gates Creek Channel not operated in 1995.

4 Included in Lower Adams River estimate.

Table 14. Escapements of pink salmon to Fraser River spawning areas for [illegible]r cycle years 1993-1999.

RUN / District / River/Stream	Estimated Number of Adult Pink [illegible]k Salmon * 1991	1993	1995	[illegible]	1997	1999
EARLY RUNS						
Lower Fraser						
Main Fraser	9,281,051					
Ruby Creek	6,783					
Total	9,287,834	N/A	N/A		N/A	N/A
Fraser Canyon						
Coquihalla River	71,555					
Jones Creek	3,558					
Nahatlatch River	35,100					
Miscellaneous Tributaries	18,333					
Total	128,546	N/A	N/A		N/A	N/A
Seton-Anderson						
Seton Creek	1,272,395					
Upper Seton Channel	13,056					
Lower Seton Channel	32,059					
Cayoosh Creek	87,388					
Portage Creek	29,008					
Bridge River	184,327					
Gates Creek	595					
Total	1,618,828	N/A	N/A		N/A	N/A
Thompson						
Thompson River and Tributaries	769,800	N/A	N/A		N/A	N/A
Upper Fraser Tributaries	2,309	N/A	N/A		N/A	N/A
EARLY-RUN TOTAL	11,807,317	N/A	N/A		N/A	N/A
LATE RUNS						
Lower Fraser Tributaries	6,929	N/A	N/A		N/A	N/A
Harrison						
Harrison River	947,812					
Weaver Creek	12,419					
Weaver Channel	2,391					
Total	962,622	N/A	N/A		N/A	N/A
Chilliwack-Vedder						
Chilliwack-Vedder Rivers	158,876					
Swelzer Creek	5,364					
Total	164,240	N/A	N/A		N/A	N/A
Miscellaneous	8,210	N/A	N/A		N/A	N/A
LATE-RUN TOTAL	1,142,001	N/A	N/A		N/A	N/A
TOTAL NET ESCAPEMENT	12,949,318	10,775,000	7,175,000	2	2,878,000	3,453,000

* Spawner abundances for individual spawning areas in the Fraser River watersh[illegible]hed are not available after 1991.

APPENDIX E: STAFF OF THE PACIFIC SALMON COMMISSION IN 1999

EXECUTIVE OFFICE

Mr. D. Kowal, Executive Secretary
Ms. J. Bakas, Secretary
Mrs. V. Ryall, Meeting Planner
Ms. T. Tarita, Librarian/Records Administrator

FINANCE AND ADMINISTRATION

Mr. K. Medlock, Comptroller
Ms. B. Dalziel, Accountant

FISHERIES MANAGEMENT DIVISION STAFF

Dr. J. Woodey, Chief

BIOMETRICS / CATCH STATISTICS GROUP

Mr. I. Guthrie, Head
Mr. D. Stelter, Catch Statistician

COMPUTER SERVICES GROUP

Ms. K. Mulholland, Computer System Manager

RACIAL IDENTIFICATION GROUP

Mr. J. Gable, Head
Ms. J. Andersen, Senior Scale Analyst
Ms. H. Derham, Scale Lab Assistant
Mr. K. Forrest, Racial Data Biologist
Mr. M. Lapointe, Sockeye Racial Analysis Biologist
Ms. M. Reichardt, Scale Analyst
Mr. B. White, Pink Racial Analysis Biologist

STOCK MONITORING GROUP

Mr. J. Cave, Head
Mr. P. Cheng, Hydroacoustics Biologist
Mr. A. Gray, Hydroacoustics Biologist (Term)
Mr. P. Van Will, Test Fishing Biologist (Term)
Dr. Y. Xie, Hydroacoustic Scientist